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Bulkhead and Load Lines Committee

THE following committee of shipbuilders, naval architects and ship owners has been designated as a result of the conference on September 27 at the office of Secretary Redfield, Department of Commerce, to consider the questions of bulkheads and load lines and report to Secretary Redfield at a later date: Stevenson Taylor, of New York, president of the American Bureau of Shipping and president of the American Society of Naval Architects and Marine Engineers; H. C. Sadler, Ann Arbor, Mich., professor of naval architecture, University of Michigan; H. N. Herriman, Cleveland, Ohio; C. J. Olson, San Francisco, Cal.; H. H. Raymond, New York, manager Clyde & Mallory Steamship Companies; T. M. Cornbrooks, Sparrows Point, Md., chief engineer and naval architect, Bethlehem Steel Company's Maryland Shipbuilding plant; William Gatewood, Newport News, Va., naval architect, Newport News Shipbuilding & Dry Dock Company; W. A. Dobson, Philadelphia, Pa., naval architect, Wm. Cramp & Sons' Ship and Engine Building Company, and J. W. Powell, Quincy, Mass., president, Fore River Shipbuilding Corporation.

The date and place of the first meeting of the committee will be arranged by Mr. Stevenson Taylor.

Naval Architects' Meeting

WITH the renewed interest in shipbuilding and shipping aroused in engineering and financial circles by the unprecedented boom in shipbuilding in the United States, the forthcoming meeting of the Society of Naval Architects and Marine Engineers in New York on November 16 and 17 should bring out the largest attendance in the history of the society. At no time in the twenty-four years since this society was organized has the need for experienced men trained in the science of naval architecture and marine engineering been more urgent. Not only are the existing facilities for shipbuilding in the country taxed to their utmost capacity to meet the steadily increasing demands for both merchant and naval vessels, but new shipyards are being established and manufacturers of machinery and marine specialties are finding in the marine field an extremely profitable outlet for their products. With the increased output in the shipyards has also come a remarkable period of scientific development which virtually marks an epoch in shipbuilding. The wide application of geared turbines to the propulsion of merchant vessels, the adoption of electric drive on large naval vessels of enormous power, the commercial introduction of the heavy oil internal combustion engine and the recent development of the hundred and one other distinctly marine lines of engineering progress have practically revolutionized marine engineering practice. As new methods and new data continually become available, the value and importance of such an institution as the Society of Naval Architects and Marine Engineers become apparent. In view of the comparatively few opportunities offered in the United States for the discussion of professional subjects relating to the building and operation of ships, the coming meeting of the naval architects with its diversified programme should be well attended and every effort should be made to increase the membership of the society, so that when in another year the society shall have rounded out a quarter century of service in this field it will fully represent the importance of this most exacting profession to the country.

Future Needs of Shipping

BESIDES the actual destruction of merchant shipping due to the European war and the rapid deterioration of the immense fleets of merchant vessels commandeered for war purposes by the belligerent nations, as outlined on another page of this issue, there are other aspects of the situation that make the continued activity of the shipbuilding industry in neutral countries and elsewhere inevitable.

In the first place, there is little likelihood that any of the belligerent nations can resume a normal output of merchant tonnage until peace is declared, and regrettable as the circumstances are there are no apparent indications of a cessation of hostilities for many months to come. In Great Britain, for instance, which hitherto has been the greatest shipbuilding center of the world, the output of merchant tonnage in 1915 was only one-half the normal output, while in the same year the losses to the British merchant marine exceeded the average output in the years immediately preceding the war. In the other belligerent nations without exception the conditions are worse. Meanwhile the international commerce of the world, after its depression in the early months of the war, is again nearly normal in value, although owing to increased prices and cost of transportation the volume is probably less than in 1913.

Radical changes, however, have occurred both in the classes of commodities and in the relative movement of international trade. In the nations at war there has been a striking falling off of exports, particularly of manufactured products, but an enormous increase of imports, chiefly of foodstuffs, materials and war supplies. On the other hand, in neutral countries generally the conditions have been reversed with a corresponding increase in exports and a falling off in imports. Moreover, the movement of the world's commerce is gradually being shifted into the hands of marine interests hitherto unable to compete for this trade. This readjustment, of course, is contingent in a large measure upon the duration of the war, and as soon as the warring nations return to peaceful pursuits home products will again become a factor of increasing importance, and both the nature and distribution of international commerce must again be readjusted.

The restoration of peace, however, will not mean the immediate release to international commerce of the enormous fleets of merchant vessels commandeered by the

governments at war. A long period of restoration will be at hand. The transport of troops, materials and supplies will require the continued use for many months of a large portion of the tonnage already in government service. Restoration of the devastated lands in the war zone and the resumption of engineering and manufacturing projects long held in abeyance by the war will immednately call for the transportation across seas of enormous quantities of materials and manufactured products, and the demand for merchant tonnage will in all probably tend to increase rather than lessen.

Bids for New Warships

BIDS were opened at the Navy Department on October 25 for the construction of the battleships *Colorado, Maryland, Washington* and *West Virginia,* and the twenty destroyers authorized last August in the naval appropriation act. Further bids for the four 35-knot battle cruisers and twenty submarines authorized in the same act will be opened on November 1.

All of the bids for the battleships were within the $11,500,000 (£2,360,000) limit set by the government, ranging from $10,060,000 (£2,060,000) to $11,475,000 (£2,350,000). The minimum time of completion, however, was thirty-nine months for one ship and forty-five months for all four ships.

Five yards submitted bids for the destroyers, but one bid from the Seattle Construction & Dry Dock Company, Seattle, Wash., was thrown out, as it was above the limit of $1,200,000 (£246,000) set by Congress. The bids ranged from $1,150,000 (£236,000) to $1,195,000 (£245,000) and the time of delivery from twenty-two to twenty-eight months.

It is believed that the Fore River Shipbuilding Company, Quincy, Mass., and the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., will each be awarded contracts for two of the battleships, although there is a possibility that the contract for one of the vessels may be given to the New York Shipbuilding Company, Camden, N. J. The Bath Iron Works, Bath, Me., the Union Iron Works, San Francisco, Cal., the Fore River Shipbuilding Company, Quincy, Mass., and the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., will in all probability get the contracts for the destroyers.

The unusual conditions prevailing in the shipbuilding industry to-day were reflected in the proposals offered. In the first place the William Cramp & Sons Ship & Engine Building Company offered to build one battleship on a basis of cost plus ten percent commission, a proposal which could not be legally entertained in the case of a battleship, but which will be permissible in the case of the battle cruisers, bids for which will be opened on November 1. A somewhat similar proposal was also submitted by the California Shipbuilding Company, Long Beach, Cal., for the construction of destroyers.

This company offered to rent its shipbuilding facilities to the government for building several destroyers according to government plans and specifications on the general basis that the government deliver to the company at its plant the materials for the vessels, pay the actual cost of all labor and materials, and compensate the company for the general use of its shipbuilding berths, machinery and general supervision over the construction. This proposal was made because of the uncertainty in obtaining definite delivery of materials on the Pacific coast and because of the present unstable condition of the transcontinental freight tariffs which before the completion of the contract may increase the cost of transportation of materials to the builders' plant by as much as 40 percent.

In the proposals made by the Fore River Shipbuilding Corporation the difficulty of forecasting the probable cost of labor or materials over a period of years was met by stipulating that any increase or decreases in the prices of labor and material in the original contract which were based on the current rates of labor and material at the builders' yards should be investigated by the United States Federal Trade Commission at the end of each year and the contract price of the ships increased or decreased by corresponding amounts for the year. The reasons for making this proposal were explained by the company as follows:

Because of the present unprecedented activity in all lines of business it has not been feasible to cover by option or provisional contract more than 50 percent of the total material required. The balance must be purchased at different times during the succeeding three or four years. Should prices for materials increase during this period, as they have in the last twelve months, the cost of the materials required for the completion of the vessels would be more than double what it is to-day. Further, of an even more unstable character is the second of the two primary elements entering into the cost of shipbuilding to-day—that is, the wages. In ordinary periods of the past improved methods of construction and additional facilities have offset normal increases in wages; but within the last twelve months wages have risen at such a rate as to show costs in connection with vessels now completing above any figures which could have been expected at the dates the contracts were undertaken.

The company also pointed out that the contemplated profits in the estimates proposed represent but a fractional part of the margin obtainable to-day in all contracts for the building of merchant ships. Notwithstanding the demands for merchant vessels the company, fully recognizing the emergency confronting the United States, has for eight months past refused all contracts and has reserved a substantial capacity for such work as the Navy Department may desire to allot to it.

Why the Navy League is Interested in the Re-establishment of the Merchant Marine

That the re-establishment of the merchant marine is second only in importance, in the minds of believers in preparedness, to provision for an adequate navy is an assertion made by *Sea Power,* the official publication of the Navy League. It therefore calls upon all those who have fought for adequate ships of war to join with it to get ships of peace that may become feeders of the fleet in the great emergency. The statement follows:

The interest of the Navy League in the great question of a merchant marine is based primarily on consideration of naval necessity. A powerful navy and a large merchant fleet are complementary in a large degree. The navy must depend upon the merchant marine for auxiliary service in time of war, and, on the other hand, a great, flourishing commercial fleet competing for the world's trade requires ample protection.

A navy on a war footing is a vastly different thing from one on a peace footing. In times of peace, with the fleet in home waters, the supply of fuel, food, clothing, ammunition, etc., is a comparatively easy matter. Navy yards and fuel depots are close at hand, and only a very few

auxiliary vessels, comprising colliers, oil-tankers, refrigerator and supply ships, tenders, a repair ship and a hospital ship are needed. In war the fleet must not be tied to a home base, but must be foot-loose and free to carry its activities to any strategic point, possibly thousands of miles away. Then, not only must the train of auxiliaries accompanying the fleet be enormously increased, but there must be provided a steady stream of auxiliaries between the fleet and its base, for a fleet cannot exist without fuel and food, and cannot fight long without new supplies of men and ammunition. The demands of war would entail an increase in naval auxiliaries of literally hundreds of vessels, and if the army were involved in overseas operations it would require hundreds more.

Where are all these naval auxiliaries and army transports to be obtained? Obviously, no nation could afford to build and keep in idleness for an emergency such a fleet as would be required. Nor is it possible to buy or build them after the emergency arises. There is only one answer, our merchant marine must be large enough to furnish at need all the ships that may be required for war purposes, and in addition be able to carry on the commercial business of the country.

This necessity is secondary only to the fighting fleet itself; a fleet without a train might be utterly helpless. Hence our interest in the building up of the merchant marine.

When our people have learned the value of a merchant marine to the prosperity and well-being of the nation, and when our law makers have learned the ways and means of encouraging and fostering its growth, then the time will come when our factories and producers shall no longer have to depend upon their competitors to carry their wares to market and to supply us with raw material, and our fleet will not be tied to its base in the event of war. The expansion of our merchant marine must go hand in hand with the building of our navy. The two are equally important factors of sea power.

Will the Shipbuilding Boom Last Ten Years?

Destructive Effect of European War and Rapid Deterioration of Commandeered and Interned Vessels Insure Increased Demand for New Tonnage

BY H. L. ALDRICH *

WHEN the war broke out in August, 1914, the gross tonnage of the merchant marines of the world was approximately 50,000,000 tons.

Great Britain was credited with 21,045,049 tons. She has lost through destruction over 2,734,106 tons, leaving a balance of less than 18,310,943 tons. The government commandeered over 50 percent of the larger and more efficient vessels. Counting these as about 9,000,000 tons, it leaves only about 9,000,000 tons of British merchant vessels still in commercial service. The government is running the ships for all they are worth, so that if the war lasts two years more the commandeered ships will be fit for little else than scrap, except at enormous expense for repairs. The 9,000,000 tons of vessels still in the ocean trade will be largely old vessels of comparatively small carrying capacity, and more or less uneconomical and inefficient.

Effect of War on Merchant Tonnage

Germany was credited with 5,134,720 tons. She has lost over 600,000 tons, leaving a balance of less than 4,534,720 gross tons interned. These ships are deteriorating at the rate of 15 to 20 percent a year. Many of these are old vessels, so that this merchant marine will not be of much value at the end of two years more of war, except at enormous cost for repairs.

France began the war with 1,922,286 tons. She has lost over 309,023 tons, leaving a tonnage of something under 1,613,263. Like the other merchant marines, this one will require enormous expenditures to restore it.

The merchant marines of the other belligerents are correspondingly reduced in tonnage and efficiency.

At the outbreak of the war the United States was credited with 7,928,688 tons. Over 600,000 tons were added by foreign vessels coming under the American flag. Vessels under construction in shipyards to-day and those that have been delivered since the war broke out approximate 1,750,000 tons. American vessels lost during the war aggregate 63,580 gross tons, making the total American merchant marine in commission and under contract at least 10,215,108 tons.

Present Strength of World's Merchant Marine

Up to date the belligerent merchant marines have been reduced in tons about as follows:

Total tonnage, August 1, 1914		50,000,000
Destroyed	5,000,000	
Commandeered by British	9,000,000	
Commandeered by other belligerents	3,000,000	
Interned, Teuton Allies	4,400,000	21,400,000
Total		28,400,000

Two more years of war must of necessity result in the destruction of considerable more tonnage.

What might be called the tonnage-efficiency of the 16,400,000 tons of commandeered and interned vessels will be enormously reduced and require very large expense to keep any of it from the scrap heap.

It is apparent that with two years more of war the world's merchant marines will be considerably under 25,000,000 tons, and in tonnage-efficiency much below the standard of August 1, 1914.

How much new tonnage has been built outside of American shipyards since August 1, 1914, is only conjectured, but it is undoubtedly very small. No one can even approximate the tonnage that will be built in the next year or two.

According to Captain Robert Dollar, the shipyards of the world during the past fifteen years have built approximately 2,500,000 tons per year. Accepting this as a minimum capacity of the shipyards of the world, it will be seen that it will require pretty nearly ten years to bring the world's merchant fleets back to a sufficient tonnage to handle its world's commerce.

* President, Aldrich Publishing Company, New York.

NEW PLATE AND ANGLE SHOP AT FORE RIVER SHIPYARD, QUINCY, MASS.

Fig. 1.—View of Plate and Angle Shop, Looking East

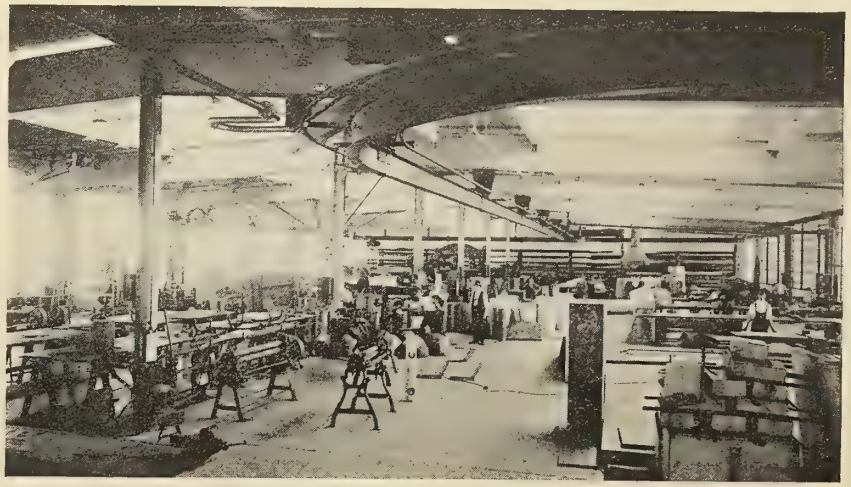


Fig. 2.—Sheet Metal Shop on Second Floor

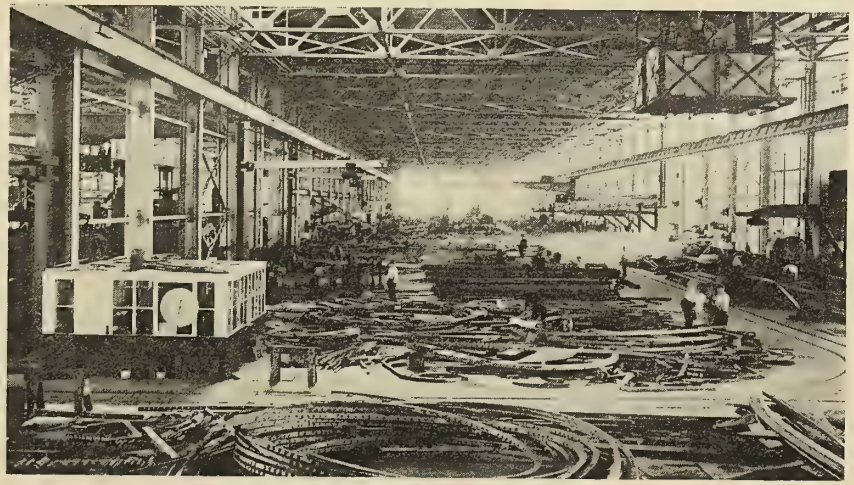


Fig. 3.—North Bay, Looking West

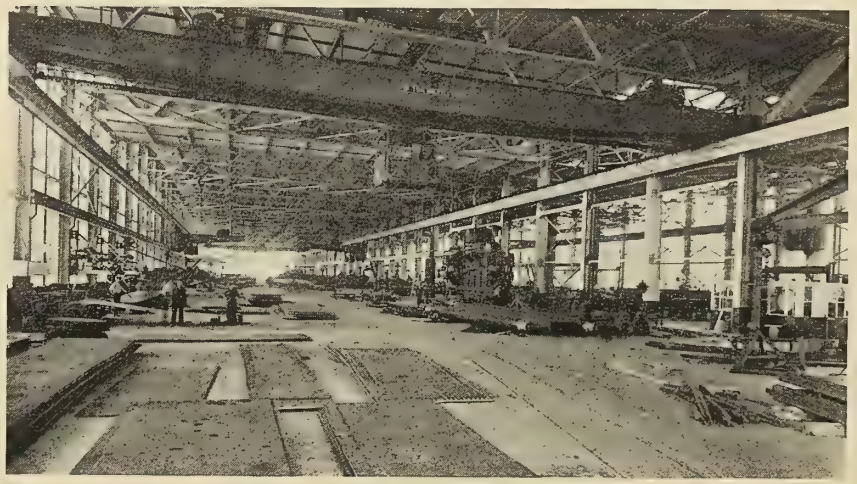


Fig. 4.—South Bay, Looking West

Fig. 5.—Mold Loft, Looking East

Huge Plate and Angle Shop and Mold Loft Completed at Fore River Shipyard

Two-Story Building, Covering Three and One-Half Acres, to House Hull Fabricating Department

WHAT is said to be the largest plate and angle shop in the world has recently been completed at the yard of the Fore River Shipbuilding Corporation, Quincy, Mass. The building is two stories in height, 769 feet long by 187 feet 10 inches wide, covering an area of 3½ acres.

The building lies east and west with a stock material yard lying north and south at the west end of the building. The stock yard receives all raw material for hull construction and is fitted with railroad tracks and gantry cranes. The majority of the stock is stowed flat and is lifted by means of magnets carried on gantry cranes. The material is conveyed from the yard into the shop by means of electric storage battery trucks, the plates being deliv-

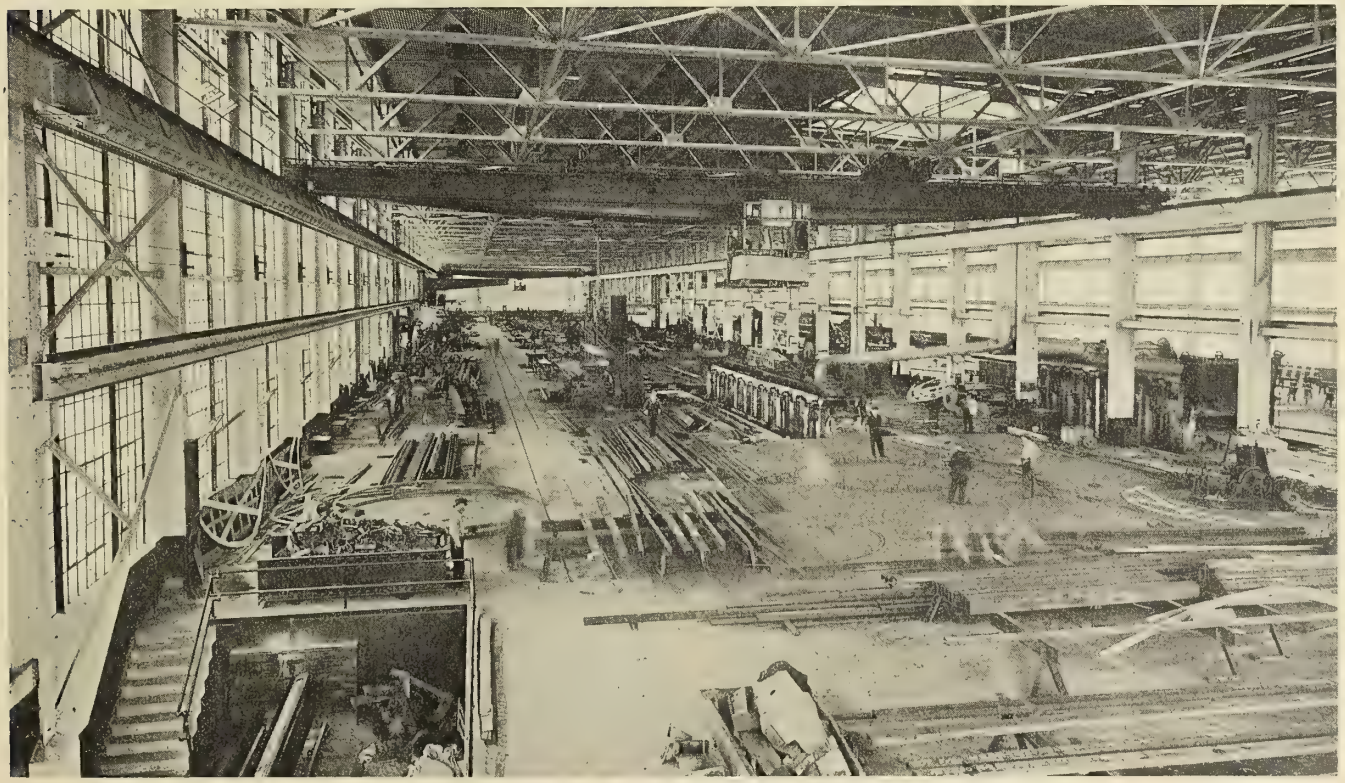
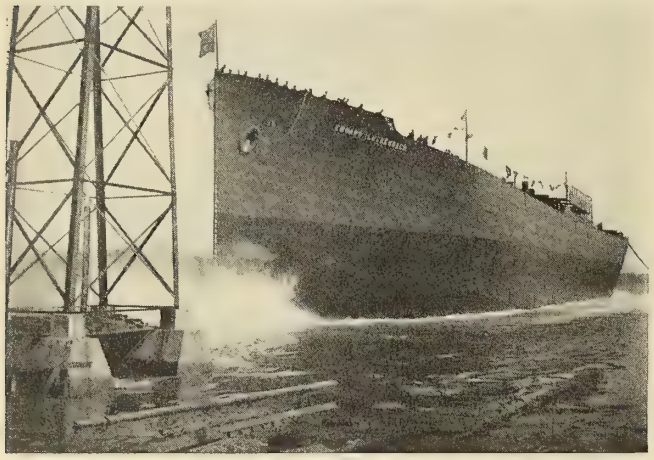


Fig. 6.—South Bay, Looking West

ered on one side of the building and shapes on the opposite side.

The building proper is divided into two parts by means of building columns, one side of the building being for plates and the other side for angles and beams, but both meeting at the east end, where the work is assembled and riveted before being put out of the shop for erection on the building slips. The electric storage battery trucks can go right through the shop from end to end and also out of the shop under the building slip cranes, all of which are located at the east end of the building, and run from east to west.

Eight of the latest type of floating punches, complete with automatic roller tables, are provided in the plate side of the shop. This side of the shop also contains the oil-burning furnaces for the heating of plates and the bending blocks. There are also two 35-foot, direct-driven



Launching of S. S. *Edward Luckenbach* at Fore River Shipyard

plate planers and one belt-driven planer, a set of straightening rolls, gate shears, countersinking machines, scarfing machines, a 25-foot, 500-ton hydraulic plate-bending machine, a hydraulic manhole punch, 35-foot bending rolls and other machinery.

The angle side of the shop is fitted with an oil-burning furnace for heating shapes and also with bending blocks and hydraulic presses for the bending of shapes to molds as required. The equipment of this part of the shop also includes the latest types of punches, bending machines, beveling machines, hydraulic juggling press, drills, countersinking machines, shears, beam bender and other machinery. At the east end of the building are laid out all the assembling skids with pneumatic bull riveting machines hung on cranes with oil-burning riveting forges nearby. Here all the work is assembled and riveted complete before leaving the shop.

The shop is fully served with 5-ton cranes running on each side of the shop and with two trolley-type, 15-ton overhead cranes and also independent jib cranes with electric hoists and post cranes. All machines in the shop are independent, electrically driven, and all can be controlled from the switchboard room in the building from which all the electric power is controlled. The building is heated by hot water, the heat being obtained from exhaust steam.

The second floor, which is reached by means of elevators, one on each end of the building, contains a mold loft and sheet metal working shop. The mold loft is 605 feet long by 93 feet wide, with a storage ell of 4,000 square feet. This loft is for the laying down of ships to full size, and is believed to be the largest mold loft in any shipyard in the world.

The sheet metal working shop is 164 feet long by 93 feet wide, with an ell 93 feet long by 41 feet wide. This shop is served by a combined passenger and freight elevator and also by an electric monorail hoist which travels from one end of the shop to the other. The machinery is all of the latest type, including power presses, rolls, punches, shears, drills, electric spot welding machines, etc.

Under the second floor and suspended from its floor trusses are groups of offices at each end of the building. Wash rooms, locker rooms, toilets and shower baths are also provided for the workmen.

Geared-Turbine Freight Steamship Launched at Fore River Shipyard

A notable addition to the fast-growing mercantile fleet of the United States was launched on September 14 from the yard of the Fore River Shipbuilding Corporation, Quincy, Mass., in the S. S. *Edward Luckenbach* for the Luckenbach Steamship Company, of New York.

This vessel, which has been designed to the owners' special requirements for coast to coast and overseas trade, is of the following dimensions:

Length over all	456 feet 6 inches
Length on waterline	449 feet 3 inches
Beam, molded	57 feet
Depth, molded	41 feet 6 inches
Deadweight carrying capacity	about 10,000 tons

The *Edward Luckenbach,* in the adoption of the modified cruiser stern, the novel arrangement of bridge and deck house bulwarks and one large smokestack amidships, and the two masts and eight kingposts, inaugurates for this rapidly growing fleet a handsome vessel of distinctive appearance and individuality that will be readily recognizable both at sea and in port.

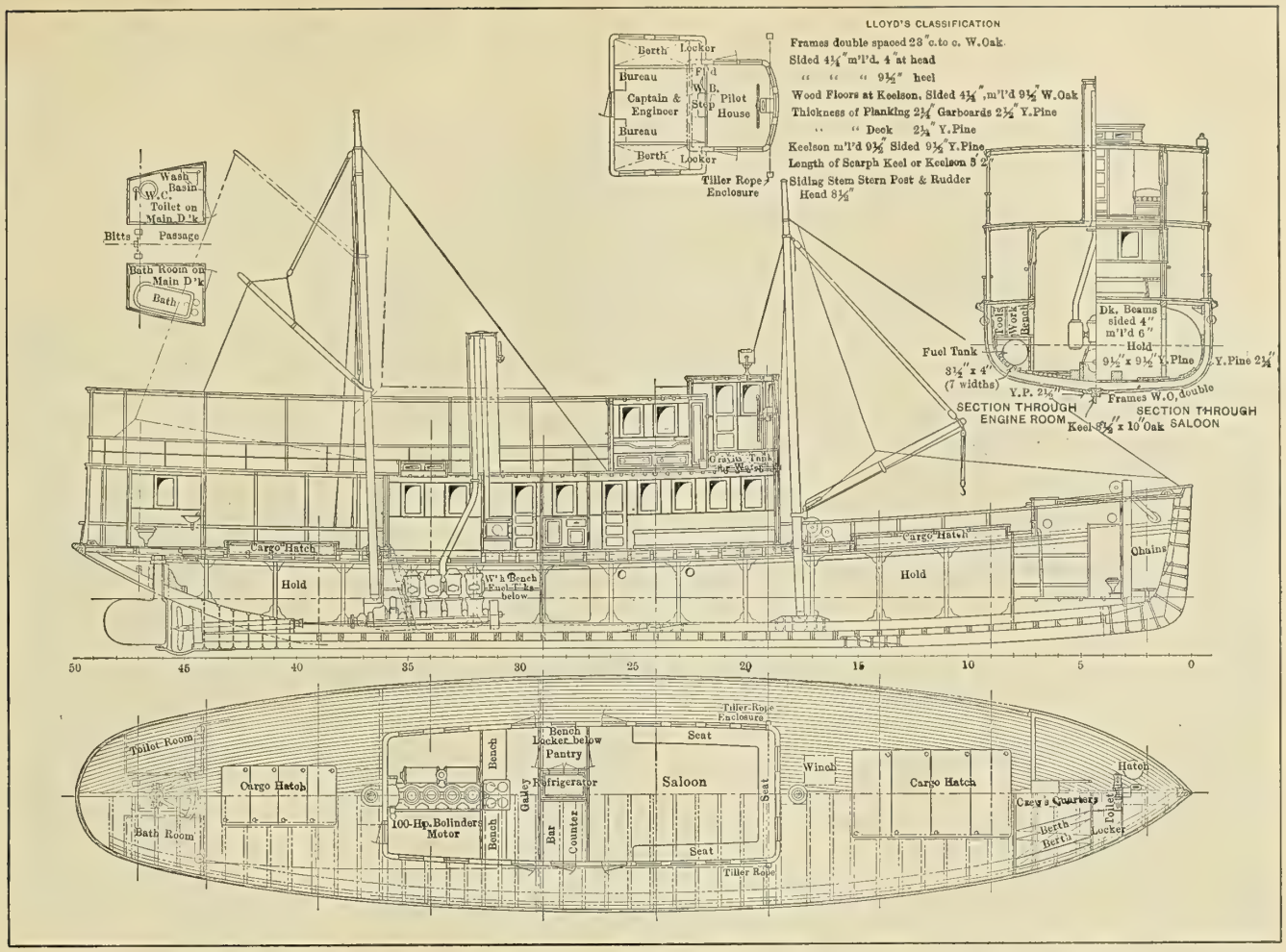
She is the first of five steamers now under construction by the Fore River Shipbuilding Corporation for the Luckenbach Line, and is a vessel of the shelter-deck type with wide-spaced hold stanchions, no side stringers, and wide-spaced frames designed for the economical carriage and rapid handling of general freight.

She has been built under the special survey and to meet the full requirements for hull, equipment and machinery of both the American Bureau of Shipping and Lloyds Register of Shipping, and will obtain the highest classification ratings, with freeboard assignment, in the records of these societies.

The propelling machinery consists of a single Curtis turbine, driving a high and low speed reduction gear designed to deliver 4,000 shaft horsepower at 90 revolutions. The maximum shaft horsepower will be 4,500, with the revolutions of the propeller not exceeding 93, and the turbine is designed to work with a steam pressure of 195 pounds in the steam chest and against a vacuum of 28 inches.

The turbine is so arranged that the head and reverse turbines are carried on one shaft and contained in one casing. The astern turbine will be capable of delivering to the shaft not less than 50 percent of the power of the ahead turbine.

The total reduction of speed between the turbine and propeller shaft will be in two steps known as the double-drive type; that is, pinions will drive two gears, one diametrically opposite the other, thereby eliminating the pressure on the pinion bearings. The high-speed pinion will be directly connected to the turbine shaft by means of a flexible coupling so arranged that any actual motion in the gears or pinions will not be transmitted to the tur-



General Plans of Wooden, Shallow Draft Passenger and Cargo Motor Boat. Designed for South American Owners

bine shaft. Each wheel will carry a right and left helical shaft gear. The low-speed reduction gear will consist of a large gear wheel driven by two pinions, each pinion being driven through a flexible connection by one of the wheels in the high-speed gear casing.

The propeller is 19 feet in diameter with blades set at a pitch of 16 feet; the pitch, however, being adjustable between 15 and 17 feet. The propeller hub is of cast iron and the blades manganese bronze.

Steam is furnished by three single-ended Scotch marine type boilers, each 16 feet 6 inches inside diameter and 12 feet 3 inches long, having a total heating surface of about 10,500 square feet. Each boiler has four Morison corrugated furnaces 42 inches inside diameter and is arranged to burn fuel oil on the Dahl system, the necessary pumps, filters, heaters, etc., being arranged in the fireroom. Fuel oil for the boilers is carried in the double-bottom compartments and the forward and after peak tanks.

The quarters for the officers and crew have received special consideration to insure good light and ventilation, together with comfort and habitability, and in these respects these vessels leave little to be desired.

American-Designed Working Boat for Cartagena, Columbia

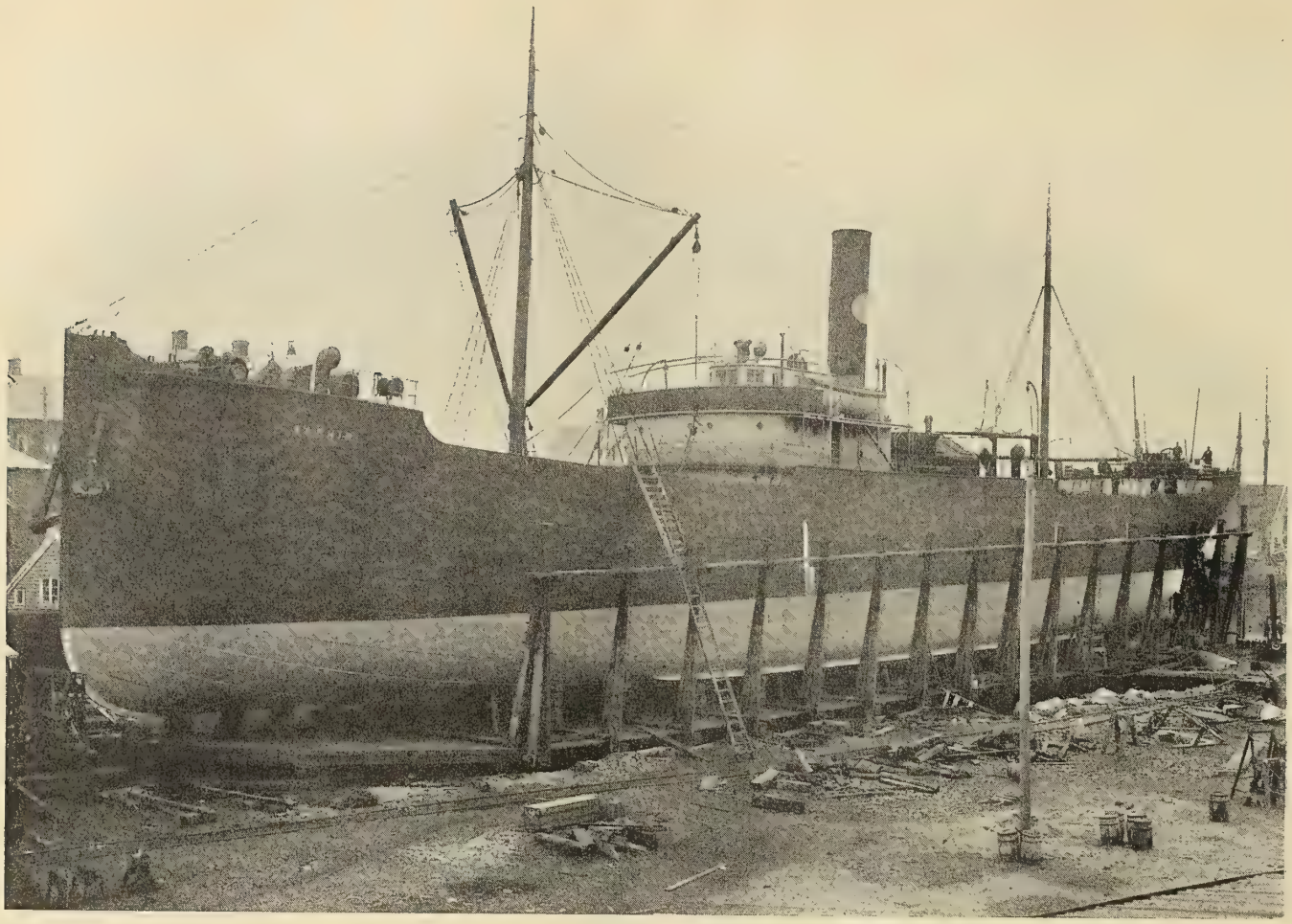
A 95-foot, shoal draft working boat to be called the *Sinu* is now being built by the Cartagena Shipyard, from designs by J. Murray Watts, naval architect, Philadelphia, Pa., for F. A. Scharberg, of Cartagena, Columbia, S. A. The dimensions are: 95 feet length over all, 90 feet length on waterline, 20 feet beam and 4 feet 6 inches draft. Propulsion is by a 100-horsepower, heavy-duty Bolinders oil engine. The boat will be used for transporting cargo and passengers up and down the river from Cartagena.

There is a good-size saloon for passengers in the deck house and plenty of room for cargo in the forward and after holds. On the upper decks are quarters for the captain and engineer, as well as the pilot house, and a covered promenade deck for passengers. A powerful electric plant is installed, which not only operates the incandescent lights and searchlight, but also the electric windlass for handling the cargo.

Another very similar boat to this, but with somewhat greater draft, is now being designed for Dr. C. A. Campbell, of Kingston, Jamaica. These boats show very clearly the tremendous strides that the oil engined motor boat is making in South America and the West Indies.

Crandall Railway Dry Docks in Scandinavia

Perhaps it is not commonly known that the type of marine railway familiarly known in the United States as the "Crandall Railway" and which is really a dry dock operated upon the inclined plane principle, has made itself known nearly all the way around the world. These railway dry docks have been built as far West as the Hawaiian Islands and the Philippines, and as far East as Piræus, Greece. Four of them are located in Scandinavia. The first of these is at Stavanger, Norway, with a capacity of 500 tons. The second was designed for parties



Crandall Railway Dry Dock of 1,800 Tons Capacity, Built at Haugesund, Norway

in Frederickshavn, Denmark, and is of 600 tons capacity. The third of 1,800 tons capacity, was built in Haugesund, Norway, in 1907.

The fourth, now about completed, is at Bergen, Norway, and has a capacity of 1,500 tons. The track is of the three-way type resting on a foundation of concrete placed on bed rock. The main dock, or "cradle," is framed entirely of riveted steel, making a strong and rigid structure to carry the vessel. The cradle, like all those of the Crandall type, carries a floor, the same as all other dry docks, over its entire length. Keel blocks, as usual, are of wood, 3½ feet high, over the main portion of the length of the dock, decreasing a little in height at the ends. The line of keel blocks has an incline of 1 foot in 44 feet. At mean high tide there are 12 feet of water forward and 17 feet aft over the keel blocks, when the cradle is all the way down. The cradle itself is 236 feet long and 50 feet wide. There are thirteen sliding bilge blocks on each side of the dock. These bilge blocks are run in and out of position by means of hand winches located upon docking platforms, which are always above water.

The cradle is operated by four 1⅞-inch special sprocket chains, each having a breaking strength of 230,000 pounds. The four chains are equipped with a patent compensating device for equalizing the load between them. They are driven by an electrically operated hoist equipped with an induction motor of 125 horsepower. A full load of 1,500 tons can be hauled up upon the cradle in twenty minutes. All of the chains and hauling machinery were made in the United States.

Destructive Storm Damages Shipping and Waterfront Property at Mobile

On the morning of July 5 a severe tropical storm swept over the city of Mobile, Ala., raging for twenty-four hours and doing several million dollars' worth of damage in and around the city. The wind reached a maximum velocity of 107 miles per hour, and throughout the storm maintained an average velocity of 85 miles per hour.

Although the loss of life is believed to be less than

Fig. 1.—Wreck of Boats *Beaver* and *Pleasure Bay*

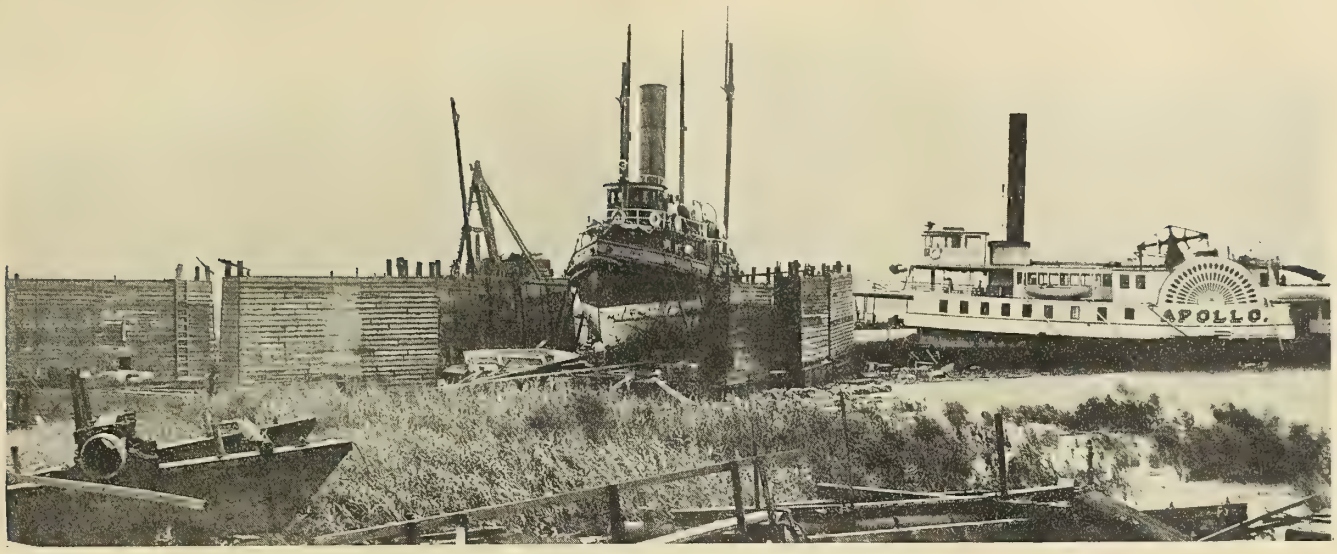


Fig. 2.—Tug *Gulfport* in Dry Dock Blown Two Miles Up Mobile River

twenty persons, practically every building in the city suffered more or less damage. The water in Mobile Bay rose 27 inches higher than during any previous storm on record, attaining a height of 8 feet in a large portion of the wholesale business district and ruining thousands of dollars' worth of merchandise.

Two river boats were perched up on the municipal docks, while several bay steamers and schooners were either wrecked or sunk. A large portion of the railroad docks were destroyed, and more than 5,000 bales of cotton

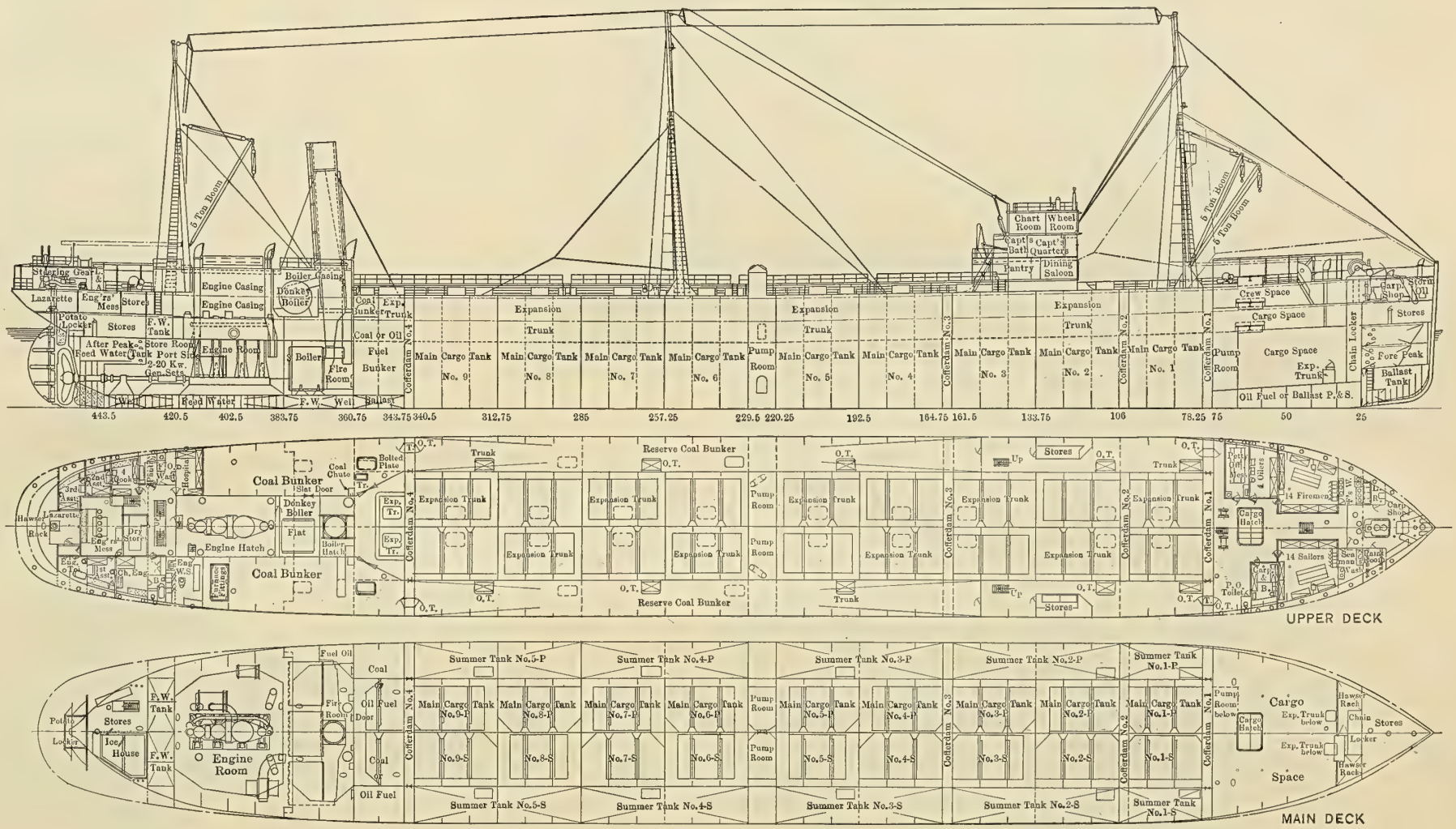
Fig. 4.—U. S. Snag Boat *William J. Twinning*, Stranded on M. & O. R. R. Wharf

Fig. 3.—Russian Ships *Frieda* and *Grace Harward* Blown on Docks of Texas Oil Company

Fig. 5.—Excursion Steamer *Charles E. Cessna* Stranded on L. & N. R. R. Wharf

LONGITUDINALLY FRAMED OIL TANK STEAMER ANTWERPEN

Built by Newport News Shipbuilding & Dry Dock Company



Profile and Deck Plans of S. S. *Antwerpen*

and much timber that was on the wharves at the time the storm began floated about the business section of the city, while some was carried out into the bay and down to the Gulf.

The tug *Gulfport* in the sectional dry dock of the Ollinger & Bruce Dry Dock Company, shown in Fig. 2, was blown a distance of about two miles up the Mobile river during the storm. The tug was not damaged and stayed on the blocks in the dock. To the right of the dock is shown the excursion steamer *Apollo,* which was torn loose from her moorings at the foot of Dauphin street, 1½ miles away, without much damage to her hull. Between the dock and the steamer *Apollo* lies the pilot boat *Wayfarer,* which was also blown from her moorings at the yard of the Ollinger & Bruce Dry Dock Company. This vessel suffered slight damage to her rigging and hull.

The wreckage in the foreground of the photograph, shown in Fig. 2, is part of the pipe line and pontoons of the United States Government dredges that were at work in the harbor.

Two Russian ships, the *Frieda* and *Grace Harward,* were blown on the docks of the Texas Oil Company during the storm. The position of these vessels is shown in Fig. 3. The wreckage at the left of the Russian ships is what remains of the river towboat *Martha Hennen.*

Another vessel that was blown from her moorings at the yard of the Ollinger & Bruce Dry Dock Company is shown in Fig. 4. This is the United States snag boat *William J. Twinning,* and she was stranded on top of the wharf of the M. & O. Railroad Company. Another river boat, the excursion steamer *Charles E. Cessna,* met a similar fate. This boat, however, was stranded on the wharf of the L. & N. Railroad at the foot of Theatre street, as shown in Fig. 5.

Oil Tank Steamer Antwerpen

Description of Bulk Oil Carrier of 11,500 Tons Deadweight Capacity Built at Newport News

THE building of bulk oil carriers, which started in this country about thirty years ago, has grown to be of such magnitude that it constitutes more than half of the merchant shipbuilding of the Coast shipyards.

The first tanker built by the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., was completed in 1906, and had a deadweight carrying capacity of about seven thousand tons. Eleven tankers have been built since by that company, exclusive of barges and vessels converted into tankers, the latest of which was the *Antwerpen,* recently sunk on her maiden voyage. The company has seven tankers under contract for delivery within the next two years.

Principal Dimensions

The *Antwerpen* was 474 feet 7 inches long over all, 60 feet beam and 36 feet 2 inches deep to shelter deck, with a deadweight carrying capacity of over eleven thousand five hundred tons, at a draft of about 26 feet 2 inches, corresponding to Lloyds summer freeboard. This vessel was not the largest tanker built at Newport News but was of a size which has recommended itself to the oil companies as generally serviceable. It will be noticed that its carrying capacity was about two-thirds greater than that of the tanker built ten years ago.

The particular feature in connection with the cargo oil tanks on this vessel is that the expansion trunks extend to the shelter deck in every case. This provides a larger cubic capacity and enables a full cargo of very light oil to be carried. Moreover, any fumes which may come from open hatches during the operation of filling the tanks are above the weather deck and cannot accumulate below the shelter deck. The total capacity of the main and summer tanks is over 500,000 cubic feet.

Bunker Capacity

The *Antwerpen* was built for burning either coal or liquid fuel. When burning coal the bunkers will hold over 1,400 tons, and when burning oil the bunkers will carry about 280,000 gallons, besides what can be carried in one of the cofferdams, and as many of the smaller cargo tanks as are not in use for the carriage of the cargo oil.

The vessel was fitted with quadruple expansion, reciprocating engines furnished with steam by three Scotch boilers, all located in the stern so as to be clear of the oil tanks. The oil fuel installation was in operation when the vessel cleared. A speed of about eleven knots when loaded was shown by the results of the trial trip, and the economy in fuel consumption was such as to require only about 34 gallons of fuel per knot.

The sailors and firemen were berthed under the shelter deck forward, and the engineers were berthed under the shelter deck aft, while the captain and deck officers had quarters in houses amidships. Provision was made for a crew of about 48 persons, but when operating as an oil burner a very much smaller crew is sufficient.

The *Antwerpen* was registered as an American vessel hailing from Newport News, but was transferred to the Dutch flag before leaving the builders' yard. The vessel was built with longitudinal framing, and the general arrangement is indicated on the drawings reproduced on the opposite page.

Hendricks' Commercial Register

The twenty-fifth annual edition of Hendricks' Commercial Register of the United States for Buyers and Sellers, which has just been issued, rounds out a quarter of a century of usefulness by this standard publication. The work is especially devoted to the interests of the architectural, contracting, electrical, engineering, hardware, iron, mechanical, mill, mining, quarrying, railroad, steel and kindred industries, containing about 350,000 names and addresses, with upward of 45,000 business classifications. Full lists are included of producers, manufacturers, dealers and consumers, listing all products, from the new material to the finished article, together with the concerns handling these products, from the producer to the consumer.

There are 1,512 pages of text matter and the index of contents numbers 149 pages covering over 50,000 trade references. The list of trade names, brands, titles of identification, etc., is published for the first time, and numbers 202 pages.

NEW WATERTUBE BOILERS INSTALLED ON S. S. MINNESOTA

Boilers of Heine Union Type, Built and Installed by the Union Iron Works Company, San Francisco, Cal.

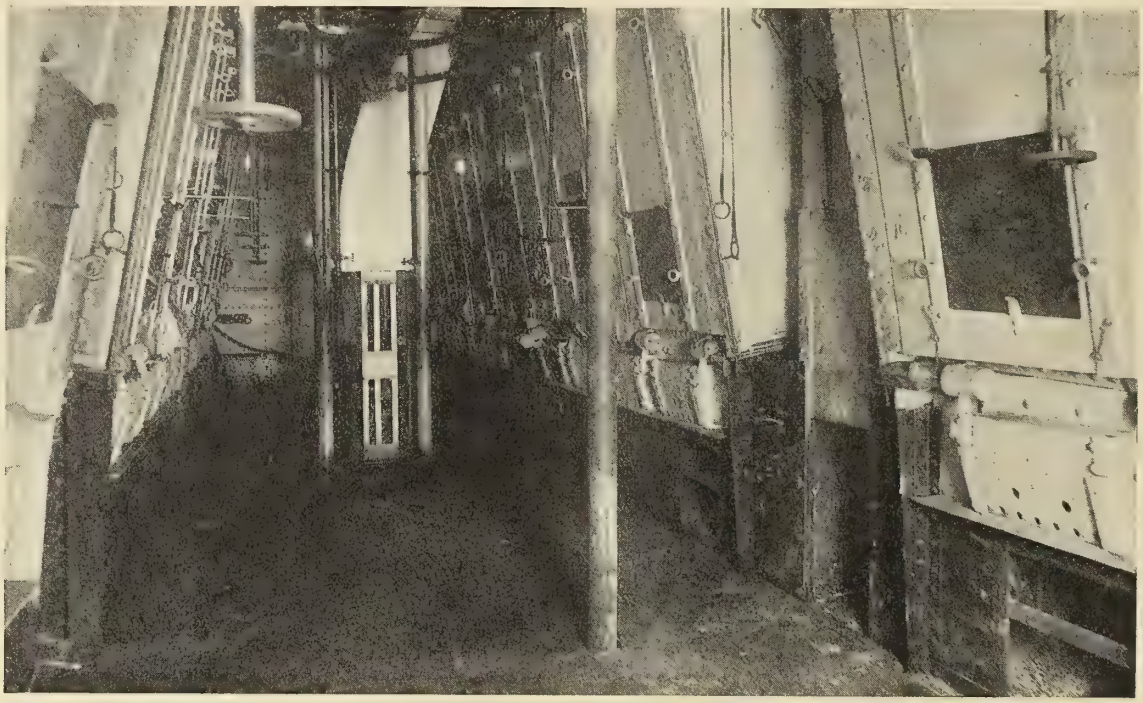


Fig. 1.—View in New Fireroom

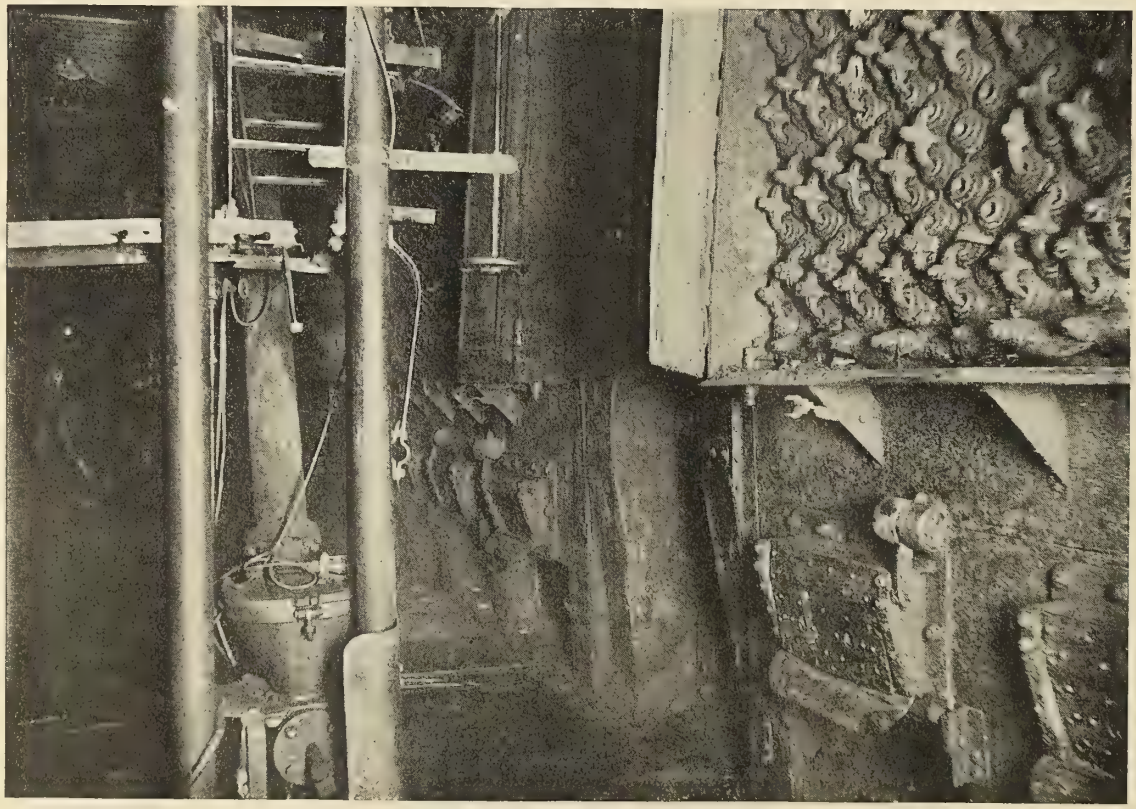


Fig. 2.—View in Old Fireroom

Fig. 3.—S. S. *Minnesota* Alongside Wharf to Receive Finishing Touches After Reboilering

S. S. Minnesota Fitted With New Boilers

Sixteen Union Heine Watertube Boilers, Total Heating Surface 43,500 Square Feet, Working Pressure 250 Pounds. Installed in Record Time

THE steamship *Minnesota* left Seattle on a voyage to Europe with a general cargo in December, 1915. When off the coast of lower California her boilers became in such bad condition that she was forced to return, arriving at San Francisco on December 14.

After several surveys and examinations it was finally decided to remove the old and install new boilers. The contract was awarded to the Union Iron Works Company to build and install complete and ready for sea sixteen Union Heine boilers. The contract was signed in January, 1916, with the understanding that the work would be completed on November 1, 1916.

Fig. 4.—New Boilers Under Construction for S. S. *Minnesota*

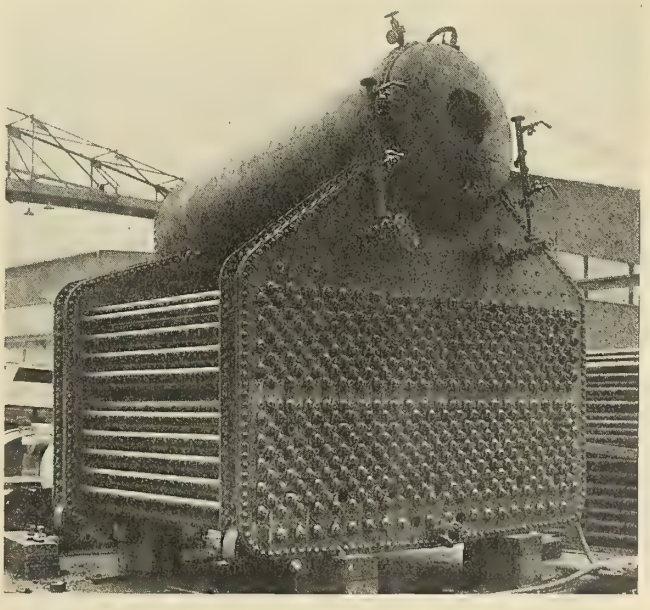


Fig. 5.—Union Heine Watertube Boiler for S. S. *Minnesota*

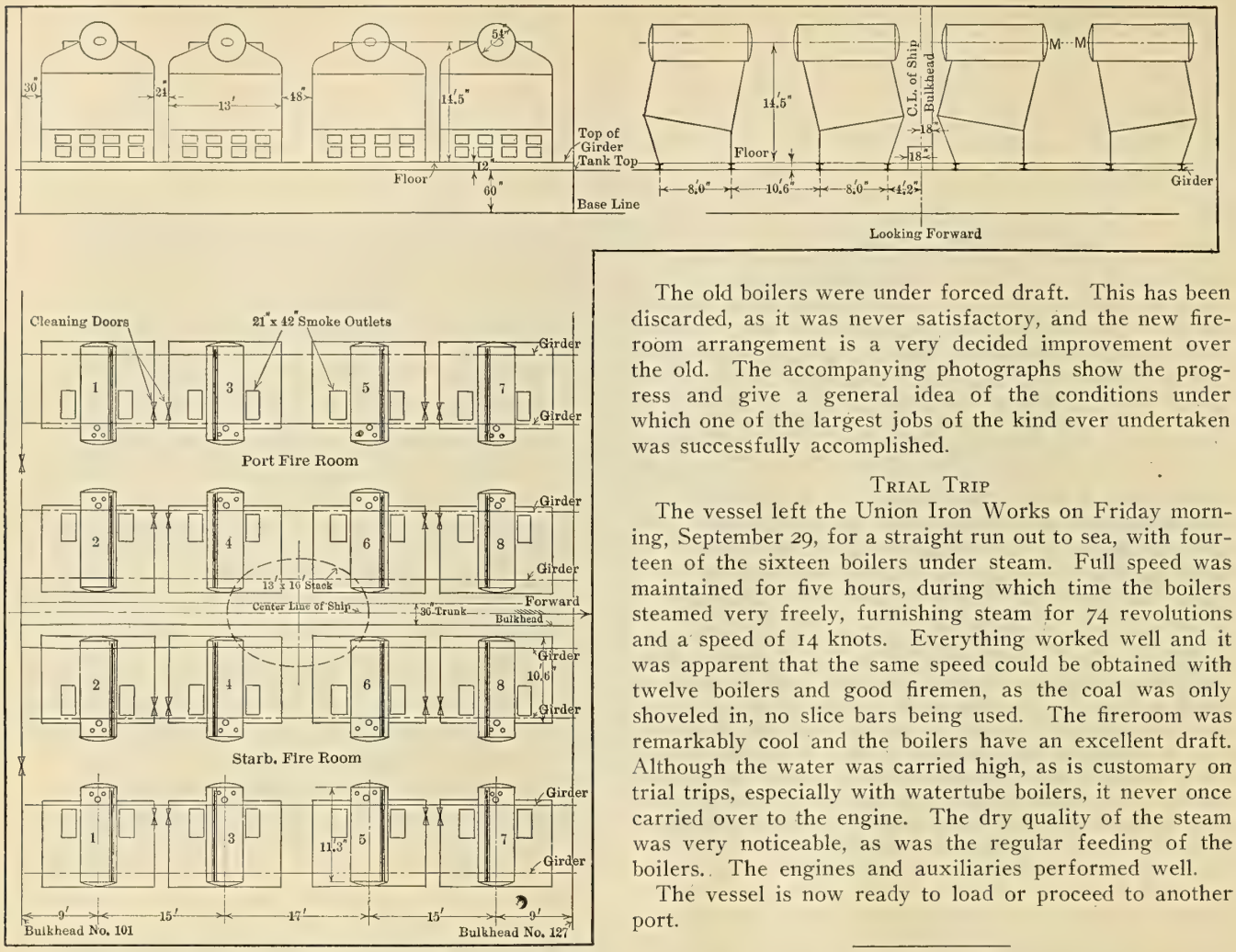


Fig. 6.—Plan, Side and End Elevation of Fireroom, S. S. *Minnesota*, Showing Arrangement of New Boilers

Considerable difficulty was experienced in obtaining material and the design of the boilers was somewhat modified on this account. The first material arrived in the yard on March 17. The crowded conditions of the shops at the yard necessitated carrying out the major portion of the work in the open. Fortunately the weather held good and the first boiler was tested on May 20 and the last was tested on July 19 and landed on the foundations in the vessel on July 20. Fires were lighted and steam raised on August 28. The boilers were tested by the United States inspectors and were under full steam and the whole installation complete on September 15.

The vessel was fully loaded, and owing to the deep draft the work was done in the bay, about 1½ miles from the works. Steam had to be kept up continuously, and for this purpose a large cylindrical boiler was placed on deck, with oil and water tanks, also dynamos and compressors. Steam was never off the vessel during this time. The smoke stack was cut off and moved to one side and all of the uptakes, etc., taken out, and the new ones installed in the same manner. A 12-ton derrick was erected on one side, which did all the lifting except the boilers, which weighed 20 tons. They were put aboard by a special boom rigged at the end of the boiler hatch.

In addition to the boilers the whole engine rooms were gutted of old and obsolete auxiliaries, piping, etc., and gratings and ladders rearranged. New feed heaters, evaporators, feed pumps, etc., and a much simpler arrangement of piping was installed.

The old boilers were under forced draft. This has been discarded, as it was never satisfactory, and the new fireroom arrangement is a very decided improvement over the old. The accompanying photographs show the progress and give a general idea of the conditions under which one of the largest jobs of the kind ever undertaken was successfully accomplished.

Trial Trip

The vessel left the Union Iron Works on Friday morning, September 29, for a straight run out to sea, with fourteen of the sixteen boilers under steam. Full speed was maintained for five hours, during which time the boilers steamed very freely, furnishing steam for 74 revolutions and a speed of 14 knots. Everything worked well and it was apparent that the same speed could be obtained with twelve boilers and good firemen, as the coal was only shoveled in, no slice bars being used. The fireroom was remarkably cool and the boilers have an excellent draft. Although the water was carried high, as is customary on trial trips, especially with watertube boilers, it never once carried over to the engine. The dry quality of the steam was very noticeable, as was the regular feeding of the boilers. The engines and auxiliaries performed well.

The vessel is now ready to load or proceed to another port.

United States Shipbuilding Reports.—The Bureau of Navigation, Department of Commerce, reports 94 sailing, steam, gas and unrigged vessels of 38,423 gross tons built in the United States and officially numbered during the month of September. Eight of these vessels, comprising 22,987 gross tons, were steel steamships. During the three months ended September 20, 337 sailing, steam, gas and unrigged vessls of 117,884 gross tons were built in the United States and officially numbered, as against 316 vessels of 46,276 gross tons for the corresponding period of 1915. There were also built during this period six vessels of 5,343 gross tons for foreign ownership.

Lloyds Shipbuilding Returns.—The returns compiled by Lloyds Register of Shipping, which only take into account vessels of 100 tons and upwards the construction of which has actually begun, show that there were 469 merchant vessels of 1,789,054 gross tons under construction in the United Kingdom at the close of the quarter ended September 30. The tonnage now under construction in the United Kingdom is about 249,000 tons more than that which was in hand at the end of the last quarter and about 253,000 tons more than the tonnage building twelve months ago.

Isherwood-Framed Ships Building in the United States.—The total number of vessels with the Isherwood system of longitudinal framing now building, or on order, in the United States is 107, with an aggregate deadweight carrying capacity of about 1,121,000 tons. These vessels comprise about 90 percent of the total oil tank tonnage and about 60 percent of the total merchant tonnage now being constructed in the United States.

Seattle's Steamship Terminals

Six Million Dollars Expended by Port Commission for New Wharves, Warehouses and Accessories

BY GILBERT C. DOHM

THE port of Seattle, situated on Elliott Bay, an arm of Puget Sound, and about 125 miles from Cape Flattery, can now boast of being one of the world's leading seaports and the greatest on the Pacific Coast. The business transacted over its wharves amounts to over one million dollars daily, an amount which is outclassed by only two other ports in the United States, New York and Philadelphia.

In 1914 the total business carried on over its wharves amounted to about $154,610,000 (£31,700,000), while 1915 showed an increase of $103,183,000 (£21,200,000) over the previous year. The first seven months of 1916 have, however, established a new record, for over $227,237,000 (£46,600,000) worth of business has thus far been carried on, making an average of over a million dollars a day.

This vast increase in shipping is due to the many advantages found at this port, including the following:

The harbor is extensive, sheltered by the surrounding mountains from severe storms, deep and absolutely free of rock, reefs or other obstruction which would endanger or hinder navigation.

It is the freest port in the world from the shipowner's point of view, the cost of loading or discharging cargo being less than any of the other great ports.

It is the principal port of distribution, due to its central location, for trade with Alaska, the Orient, Siberia, British Columbia, many of the islands in the Pacific Ocean, and for our own Northern States.

On account of the extreme width of Elliott Bay (almost five miles) and the unobstructed passage into Puget Sound

Fig. 1.—Bell Street Public Terminals. One of Six Terminal Groups Built by Port Commission

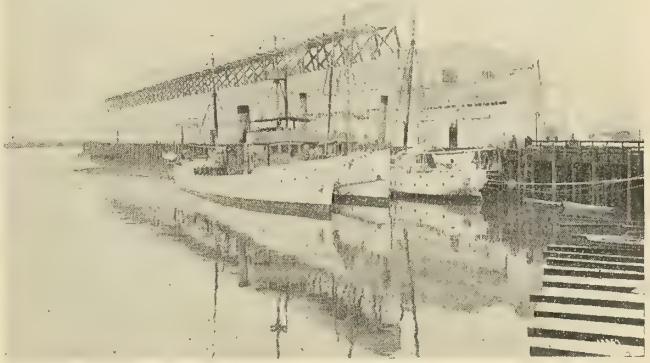


Fig. 2.—Hanford Street Wharf. 1,400 Feet of Deep-Sea Berthage. Concrete Grain Elevator (500,000 bushels capacity) in Rear

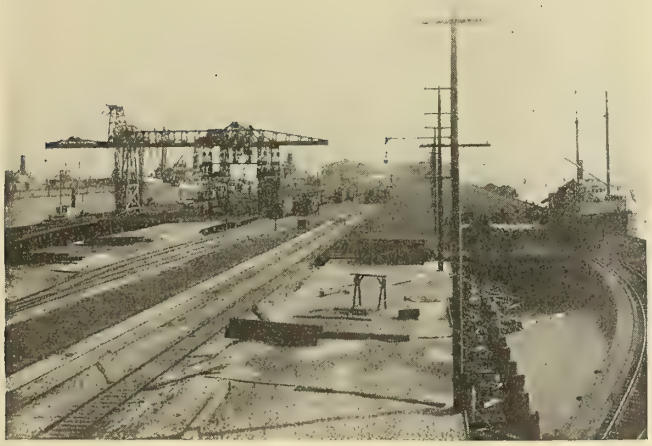


Fig. 3.—Smith's Cove Terminal. Giant Gantry and Locomotive Cranes

Fig. 4.—Stacy-Lander Slip, 800 Feet Long and 213 Feet Wide Between Fender Lines

and the Pacific Ocean, no tugboats are necessary to guide the ships to any respective channel.

There are no compulsory pilotage regulations, though all foreign steamship lines employ a pilot from Port Townsend, a distance of about forty miles from Seattle.

The vessels may shift from one part of the harbor to another under their own steam. In most other ports the aid of a tugboat is required, and an additional pilotage charge is also encumbered.

Soft coal may be obtained cheaper at Seattle than any other Pacific Coast port, but the cost of fuel oil is slightly in excess to some of the ports along this coast.

The cost of fresh water is very low, being $0.80 (3/4) for the first 1000 cubic feet and gradually decreasing in cost per 1000 feet as the quantity increases.

There are no charges for docking at any of Seattle's wharves, and the charges for vessels moored at any one of the eight steel mooring buoys in the bay is nominal being $5.00 (1/0/10) for the first three days and $2.00 (8/10) for each successive day thereafter.

The city itself is entered by ten transcontinental railroads, four of which travel over their own tracks, four using the tracks of the previous mentioned, and two entering the city by steamship connection.

Open Docking Privileges Provided by Port Commission

When the city of Seattle began to show signs of great strides forward, the railroads obtained control of most of the water front property, monopolizing the greater portion of it for their own benefit. Wharves were built by them which were used for the transportation of their own business, while other wharves also under the control of the railroads were rented to private interests. At the completion of the Panama Canal, open docking privileges became a necessity to take care of the increased sea trade. It was at this time that the Port Commission of Seattle was organized. Six million dollars were appropriated for building new wharves, elevators, warehouses, refrigerators, coal bunkers, oil receptacles, etc. The work was at once started, and to-day the terminals at Smith's Cove, Bell street, Stacy-Lander street, Whatcom avenue, Hanford street, Spokane avenue, etc., stand as a monument to the forethought of the citizens of Seattle.

The terminal at Smith's Cove is the largest of these public terminals and the largest wharf on the Pacific Coast, being one-half mile long. It is equipped with gantry cranes, locomotive cranes of fifteen tons capacity, a derrick of one hundred tons capacity and over three miles of railroad track. It is used as a general merchandise terminal in the handling of lumber and heavy cargo, and has a storage capacity of over 3,000,000 feet of lumber.

The Bell Street Terminal is centrally located, and is used for general shipping purposes, being connected to the main railroad lines by five spurs of track. Upon the roof are recreation gardens and a marine observatory.

The other terminals are all of a nature suitable for the shipment of general merchandise and the storage of fish, fruit, canned goods, etc.

Aside from the terminals a large public grain elevator has a capacity of 500,000 bushels, with a shipping capacity of 20,000 bushels per hour. The machinery is all electrically driven and of the most modern type.

All of the Port Commision wharves and warehouses are of concrete fireproof construction.

Beside the Port Commission terminals there are thirty-one other wharves owned and operated by private interests, four coal bunkers with a capacity of 15,500 tons, two oil docks with a capacity of 187,500 barrels and grain elevators with a total capacity of over 4,500,000 bushels, four floating dry docks with a total lifting capacity of 22,900 tons, and another large one in the course of construction, and two dry docks at the Puget Sound Navy Yard, about fifteen miles away.

At present there are sixty-four water lines sailing from Seattle, forty-four of these being steam lines, and with the present outlook of the shipping and shipbuilding industry the promise of more is close at hand.

Program of Naval Architects' Meeting

The twenty-fourth general meeting of the Society of Naval Architects and Marine Engineers will be held in the Engineering Societies Building, New York, on Thursday and Friday, November 16 and 17. The meeting will begin at 10 A. M. each day.

There will be a banquet in the grand ball room of the Waldorf-Astoria hotel at 7 P. M., Friday, November 17.

The following list of papers will be presented at the meetings:

THURSDAY, NOVEMBER 16

1. "New Method of Indicating the Density of Smoke as Installed on the U. S. S. *Conynham*." By Rear Admiral R. T. Hall, U. S. N.
2. "Salvage Equipment Used in Raising Submarine F-4." By Naval Constructor J. A. Furer, U. S. N.
3. "The Design of an Oil Engine." By John F. Wenthworth.
4. "Aeronautics in Relation to Naval Architecture." By Naval Constructor H. C. Richardson, U. S. N.
5. "The Power Forging of Chain Cables." By Naval Constructor F. G. Coburn, U. S. N.
6. "Description and Trials of the Turbine Steam Yacht *Winchester*." By E. A. Stevens, Jr.
7. "Theory of Fluid Friction." By W. Gatewood.
8. "Notes from Model Basin." By Naval Constructor Wm. McEntee, U. S. N.

FRIDAY, NOVEMBER 17

9. "Military and Technical Considerations of Battleship Design." By Naval Constructor R. D. Gatewood, U. S. N.
10. "On the Suitability of Current Designs of Submarines to the Needs of the U. S. Navy." By Captain W. L. Rodgers, U. S. N.
11. "Naval Stations and Naval Bases." By Captain A. P. Niblack, U. S. N.
12. "Refrigeration and Refrigerator Insulation on Board Ship." By Robert F. Massa.
13. "The Resistance of Various Types of Barges in Shallow and Deep Water." By Professor H. C. Sadler.
14. "Feathering Paddle Wheels." By Professor E. M. Bragg.
15. "Alquist Gearing for Ship Propulsion." By W. L. R. Emmet.
16. "Electric Pumping Equipment and Notes of Interest on the Union Oil Company's Tanker *La Brea*." By H. P. Frear.

Burning of Big Pacific Coastwise Passenger Steamship Congress

On September 14 the Pacific Coast Steamship Company's liner *Congress* caught fire off the Oregon Coast and was nearly destroyed. The fire started at about 3 P. M. and soon completely enveloped the after part of the ship. As soon as the fire was noticed, Captain Cousins turned his ship toward Coos Bay, which was safely reached. Here all of the passengers and crew, comprising 428 persons, were transferred without a single mishap or loss of life to the government dredge *Col. P. S. Michie*, which caught up the S. O. S. signal of distress and hurried to the assistance of the ill-fated ship.

After the the fire the *Congress* was towed to port, where temporary repairs were made on her machinery, after which she proceeded to Seattle under her own power. She was built at the New York Shipbuilding Company's plant in 1913 and was the largest Pacific coastwise liner.

BURNING OF S. S. CONGRESS

Fig. 1.—S. S. *Congress* Gutted by Fire

Fig. 2.—Rescue Ships Summoned to Burning Vessel by Wireless

BURNING OF S. S. CONGRESS

Fig. 3.—Burned Hull of S. S. *Congress* Anchored in Coos Bay

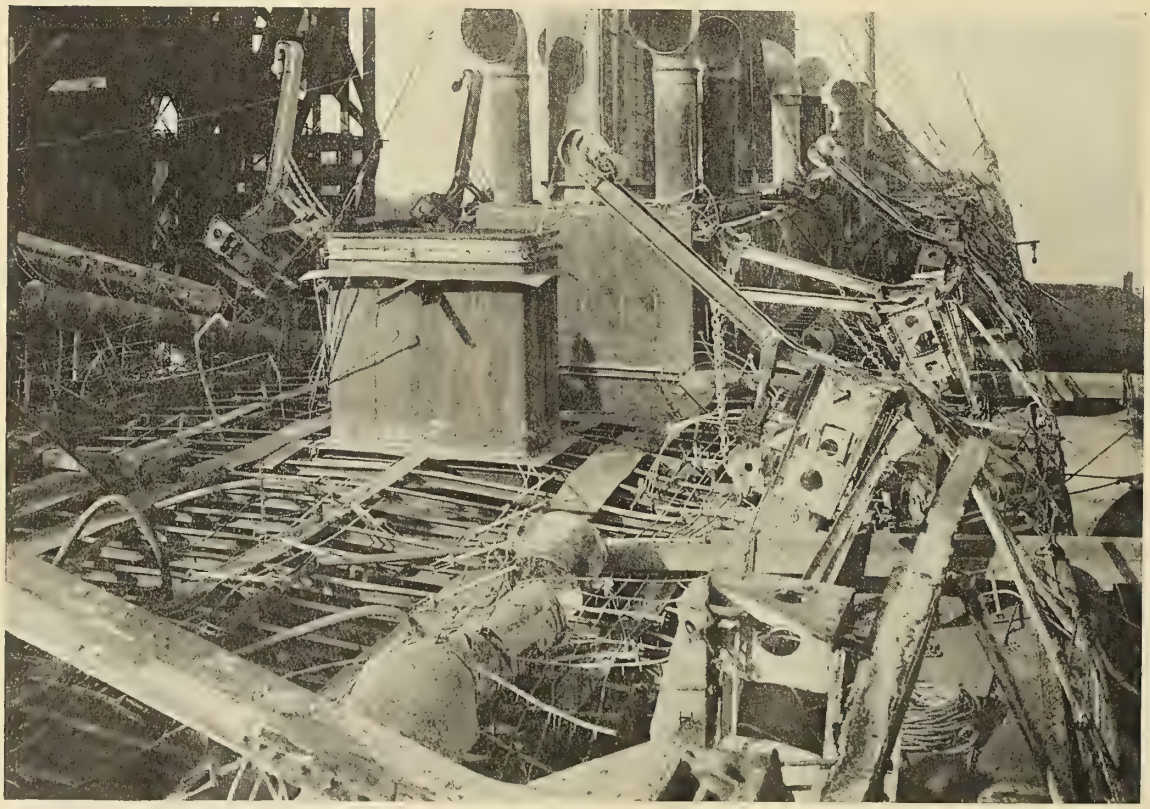


Fig. 4.—View on Decks of Burned Vessel, Showing Ruins of Upperworks

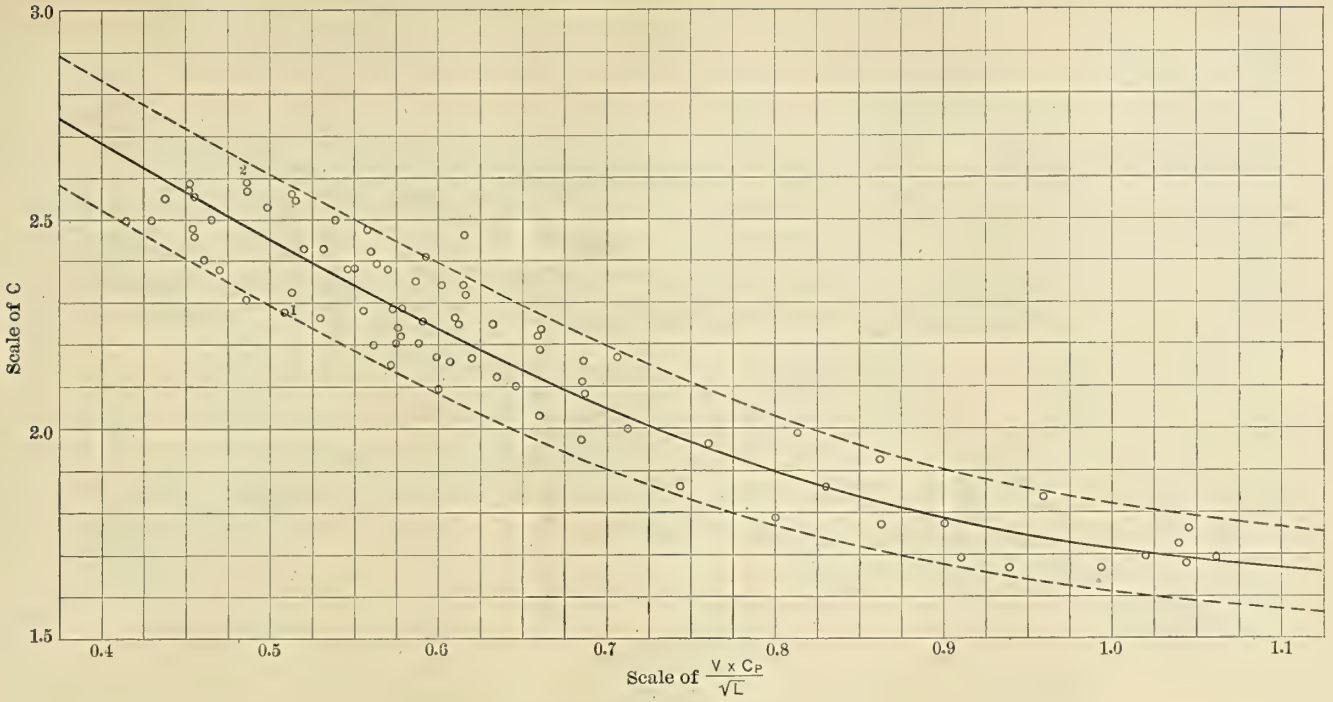


Chart I.—Curve of C Values

Power Estimating

Formula and Curves Derived as Substitute for Admiralty Method of Estimating Power

BY L. A. BAIER, B.SC.*

ONE of the most interesting phases of ship design is that practically every new vessel is a different problem in itself and is designed and built to fulfill the particular requirements imposed by the character of its cargo, run, service, terminal loading and unloading facilities, etc.

In the majority of cases the owners require a vessel to carry a certain cargo of approximately such and such a deadweight. If the depth of water in one of the ports of call is limited, this fixes at once the approximate draft for the proposed vessel, as it is usually most economical to

* Junior member Society of Naval Architects and Marine Engineers.

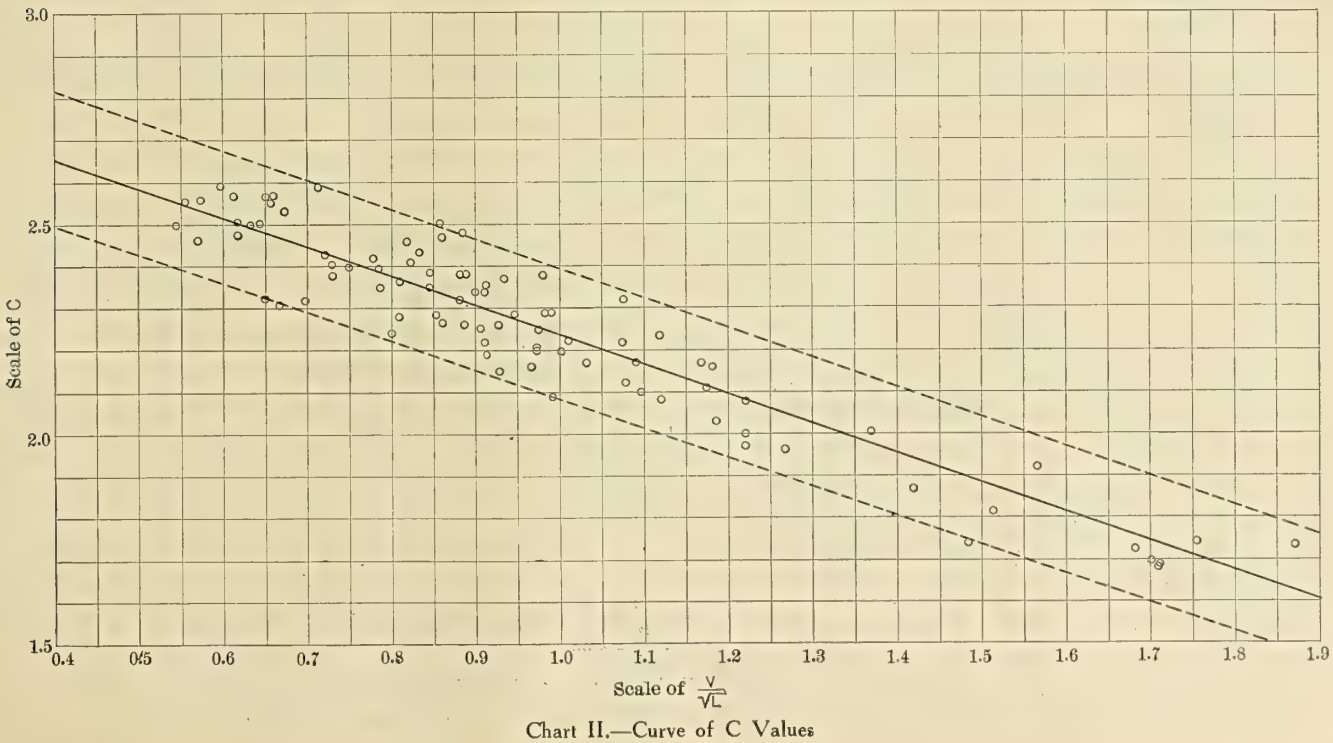


Chart II.—Curve of C Values

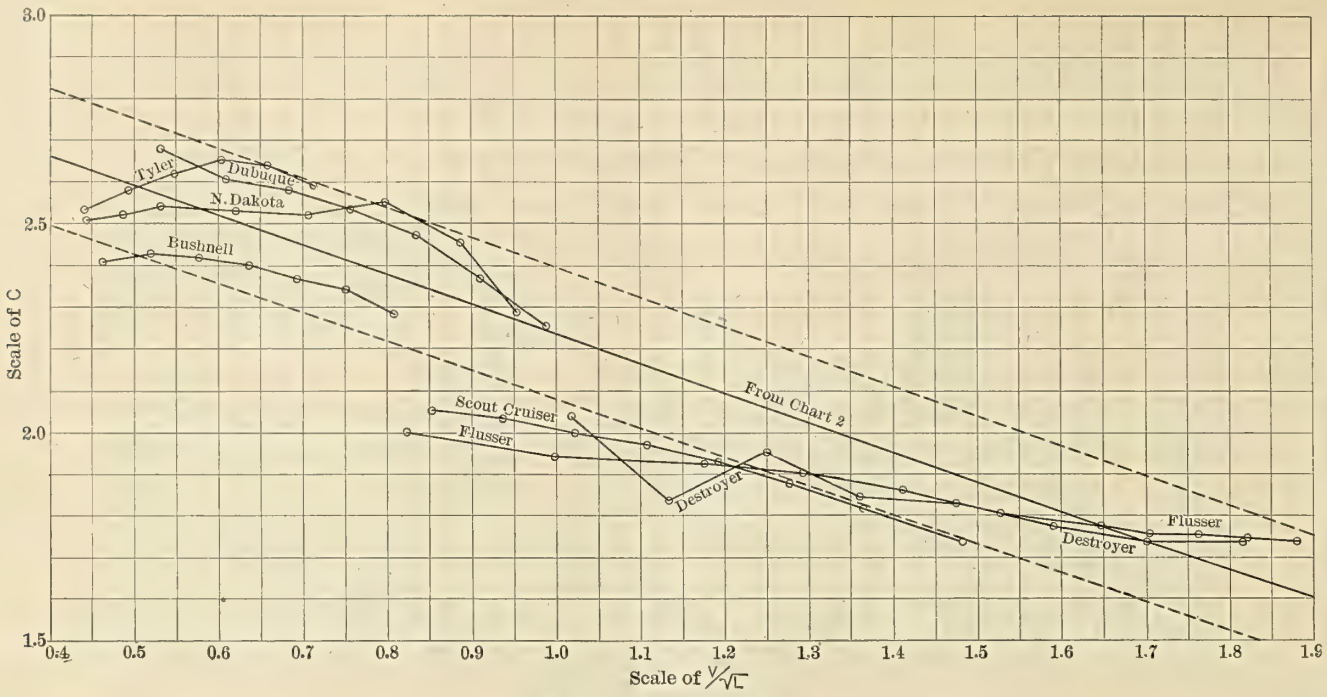


Chart III.—Progressive Trials

$C = \frac{V}{\sqrt[3]{\frac{I.H.P. \times L}{\Delta}}}$, where V = speed in knots; Δ displacement in tons, $S.W.$; L = length on load $W.L.$ For turbines $I.H.P. = \frac{S.H.P.}{0.92}$ for geared drive, and $\frac{S.H.P.}{0.97}$ for direct drive.

utilize the maximum draft allowable. The beam is largely determined by stability considerations. The character of the cargo and tentative dimensions of the vessel will determine the most economical service speed.

The service and run will usually determine the type of vessel to carry the maximum deadweight on the minimum displacement, and to realize the maximum cubic cargo capacity on the minimum tonnage rating. The vessel is usually built to the highest classification of one of the societies and must satisfy the freeboard rules, navigation laws and rulings of the Government inspection bureaus, etc.

The displacement of any vessel is, of course, equal to the total weight of the vessel and all it carries. The weights going to make up the displacement are as follows:

The weight of the hull complete comprises the steel in the hull, paint and cement, carpenter work, joiner work, hull fittings, hull engineering, equipment and outfit. Adding to this the weights of the steam engineering or machinery and ordnance gives the displacement of the vessel light. The total deadweight carried by the vessel includes the fuel, crew and effects, reserve feed water, fresh water, stores and provisions, and adding these weights to the displacement of the vessel light gives the displacement of the vessel ready for sea. Finally, the total displacement of the vessel loaded is obtained by adding to the above the weights of the passengers and baggage, cargo and ammunition.

The total displacement may be expressed by the result of a factor C_d times the total deadweight in tons. This factor will run from 1.39 in the case of certain cargo types to 4.5 in the case of passenger vessels. The de-

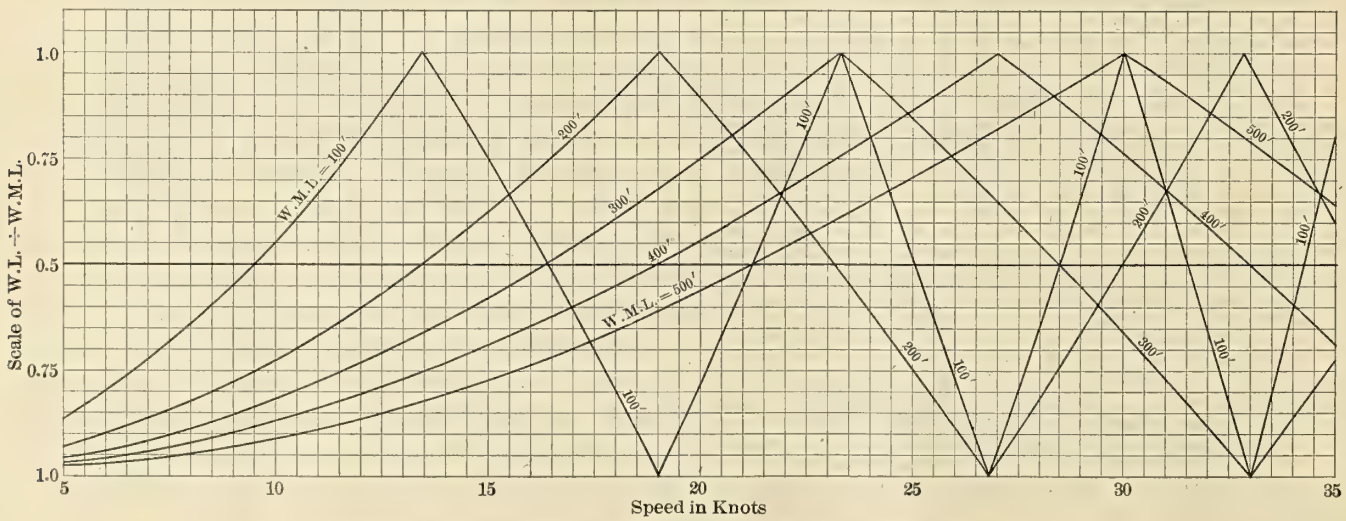


Chart IV.—Curve of Ratio of Wave Length by Wave-Making Length

Wave length $= \frac{V^2}{1.8}$. Wave-making length = 1.05 to 1.15 × L. L = Length on load $W.L.$

signer's problem, then, is to determine the combination of dimensions and form characteristics that, consistent with economy of operation and construction, stability, etc., will bring this factor C_d as low as possible.

The weight items from the foregoing table, of Steam Engineering, Fuel and Reserve Feed water, are dependent on the power involved. Hence it is necessary to know approximately in the early stages of design what power will be required for any tentative set of dimensions and displacement. The "Admiralty Coefficient," which is most commonly used, has not proven a very satisfactory one. The formula is as follows:

$$I.H.P. = \frac{\Delta^{2/3} \times V^3}{C}$$

where Δ = the displacement in tons,
V = the speed in knots,
C = a coefficient.

To obtain correct estimates of power by this method the designer must have at hand data for almost identically similar vessels. If one of the two important factors in this formula, namely, the displacement ratio, and the speed ratio varies even slightly from that of the type vessel, the admiralty coefficient will vary considerably. Again, the factor of length which has a large influence on the power is not taken into account.

The following formula and curves have been derived to give a method of estimating power in which the designer may choose the proper coefficient with less degree of error and with proper allowance for the important factors which influence the power required:

$$I.H.P. = \frac{V^3 \times \Delta}{C^3 \times L}$$

where V = speed in knots,
Δ = displacement in tons, s. w.,
L = length on waterline in feet,
C = coefficient.

For turbine installations

$$I.H.P. = \frac{S.H.P.}{0.92} \text{ for geared drive,}$$

$$I.H.P. = \frac{S.H.P.}{0.97} \text{ for direct drive.}$$

Chart I shows values of C, calculated from the trial results of some eighty vessels ranging from seagoing dredges, cargo steamers, high-speed passenger liners, to torpedo boat destroyers, plotted on a base of

$$\frac{V \times C_p}{\sqrt{L}}$$

where C_p = the prismatic coefficient.

Chart II shows values of C plotted on a base of $\frac{V}{\sqrt{L}}$ for use when the prismatic coefficient C_p is not at hand.

As shown, the values of C are found to fall within a well-defined area inclosed by the dotted curves. The full line curve represents the average values of C.

For any given abscissa C will vary above or below the average curve according to the following factors, however, practically always being found within the defined limits shown.

1. Ratio of beam over draft.
2. Propulsive coefficient.
3. Ratio of wave length over wave making length.
4. Prismatic coefficient.

If for a proposed design the ratio of beam over draft is comparatively large, say, the propulsive coefficient to be expected rather low; the ratio of wave length over wave making length, say one; and the prismatic coefficient large for this type of vessel, we would find the value of C near the lower limits of the curves. Conversely, if any of these factors is such as to favor a low resistance, C will become larger, until, if all the factors are favorable to easy driving, C will be at the upper limits of the curves. This is illustrated by points two and one on Chart I, showing the values of C for two vessels, one easy to drive and the other of large resistance for its type.

	Vessel No. 1	Vessel No. 2
Length, feet	300	331
Beam, feet	45.5	47
Draft, feet	15	16.92
Displacement, tons	3,548	4,875
Prismatic coefficient	0.629	0.682
Speed, knots	14	13
Indicated horsepower	2,740	1,870
$\frac{V \times C_p}{\sqrt{L}}$	0.508	0.487
C	2.28	2.59
Ratio beam over draft	3.03	2.78
Propulsive coefficient	0.497	0.636
Ratio wave length over wave-making length	0.67	0.73

The lines of vessel No. 2 were designed with a great deal of care, and this, combined with a very efficient propeller, resulted in a vessel remarkably easy to drive, as shown by the high value of C. In the above comparison the ratio of beam over draft, and the propulsive coefficient had the most influence in varying the values of C. For higher values of

$$\frac{V \times C_p}{\sqrt{L}}$$

the effect of differences in the ratio of wave length over wave making length becomes more important.

Chart III shows variations of C for various vessels over their progressive trials, C being plotted on a base of $V/\sqrt{L}$.

Chart IV gives curves of wave length over wave making length plotted on a base of speed V. The value of 0.5, of course, represents the most favorable ratio for ease of propulsion.

The writer hopes that the foregoing method may prove of value to those interested in obtaining fairly close estimates of power for design purposes.

Twin Screw Motor Ship Peru

The twin-screw motor ship *Peru*, built for the East Asiatic Company, recently ran her trials in the Copenhagen Sound, developing an average speed over the measured mile of 12.74 knots at 3,685 indicated horsepower and 139.3 revolutions per minute. During a four-hour consumption test the consumption of fuel oil proved to be 144.8 grammes per indicated horsepower, including the fuel oil for auxiliary motors. The fuel was Borneo crude oil of a heating value of 18,000 British thermal units.

The *Peru* is the twentieth motor ship launched from the yards of Burmeister & Wain, Copenhagen, and is of the following dimensions: Length between perpendiculars, 425 feet; beam, 55 feet; depth, 30 feet 6 inches; draft, 26 feet 5 inches; deadweight carrying capacity, 9,500 tons. She is fitted with two six-cylinder main engines developing a total of 3,100 indicated horsepower at 125 revolutions per minute designed to give the ship a speed of 11.15 knots. The vessel is further equipped with three two-cylinder auxiliary Diesel engines, each developing 90 brake horsepower at 300 revolutions per minute directly coupled to dynamos supplying current for operating of all the auxiliary machinery. In the engine room a donkey boiler furnishes steam for heating purposes and for driving a steam-driven auxiliary air compressor.

Fig. 1.—S. S. *Wyandotte.* Unloading Capacity 600 Tons per Hour

The Use of Conveying Machinery for Handling Bulk Freight on Board Ship

Lake Bulk Freighters Equipped with Self-Unloading Machinery—Self-Unloading Barges and Fuel Lighters—Conveying Machinery Electrically Driven

BY W. B. GREENE *

A NUMBER of the stone-crushing plants along the Great Lakes find their readiest market in nearby lake towns which are not equipped with special unloading docks. In delivering to these towns by ordinary freighters it is found that the vessel is tied up at the docks for a greater time than is used in actual transportation. This situation has been nicely met in a number of cases by equipping vessels with self-unloading machinery with unloading capacity equal to the average "fast" plant. The economic importance of this equipment is particularly apparent where the vessel is operating between nearby points, when the percentage of idle time due to the loading and unloading operation is very high.

The first of the vessels so equipped was the *Wyandotte,* a 310-foot vessel with a cargo capacity of 3,300 tons and an unloading capacity of 600 tons per hour. This was followed by a somewhat larger boat, the *Alpena,* built for the same owners. This vessel is 370 feet long overall, with 5,700 tons carrying capacity and an unloading capacity of 750 tons per hour. A third boat, the *Calcite,* 436 feet long, carries 8,300 tons, which it discharges by means of its own power and equipment at the rate of 900 tons per hour.

The general arrangement of the three boats is the same. Cargo is carried in a double row of hoppers provided with bottom gates and covered with wide hatchways separated by narrow deck strips. Beneath each row of hoppers is a 36-inch by 188-foot pan conveyor operating horizontally except for a slight incline at the head end. These discharge near the bow of the vessel onto a single inclined belt conveyor, 42 inches by 100 feet, rising on an incline toward the stern to a point above the deck. A fourth conveyor, 42-inch belt by 80-foot centers, is carried on a steel struss revolving boom, permitting the load to be discharged to either side of the vessel. One 90 horsepower motor drives the two pan conveyors and the inclined belt conveyor. The boom conveyor is operated by a 35 horsepower motor and the boom itself is swung by means of a donkey engine through a rope attached to the head of the boom.

The same arrangement obtains on the *Alpena,* on a somewhat larger scale, but with better space economy by the substitution of a heavy inclined bucket elevator for the intermediate belt conveyor. The conveying systems consist of two 36-inch by 264-foot steel pan conveyors discharging to a 54-inch by 60-foot bucket elevator, this in turn discharging to a 36-inch by 77-foot belt conveyor on the revolving boom.

The *Calcite* adopted the mechanical arrangement of the *Alpena* in substantial details on a still larger scale. The gathering conveyors are of the pan type, 42 inches by 310 feet. The incline bucket elevator is 72 inches by 67 feet and the boom belt conveyor is 48 inches by 90 feet.

This same idea has also been profitably applied on a smaller scale to several barges. These may or may not be propelled under their own power. The 1,200-ton barge *Adriatic,* on the Great Lakes, has a double row of hoppers and a system of conveyors and elevators similar to those used on the larger vessels described. This barge carries a 55-foot boom conveyor and discharges at the rate of 120 tons per hour. The San Pablo Quarry Company barge *No.* 1, operating on the Pacific Coast, carries a single row of hoppers and the unloading equipment consists of a belt conveyor delivering to an elevator carried on a revolving base.

Usually where barges are thus equipped they are owned and operated by the producing company. In the case of the larger vessels they have been built by transportation companies, although usually to serve a definite established trade or business which frequently controls the transportation company.

* Engineer, Stephens-Adamson Manufacturing Company, Aurora, Ill.

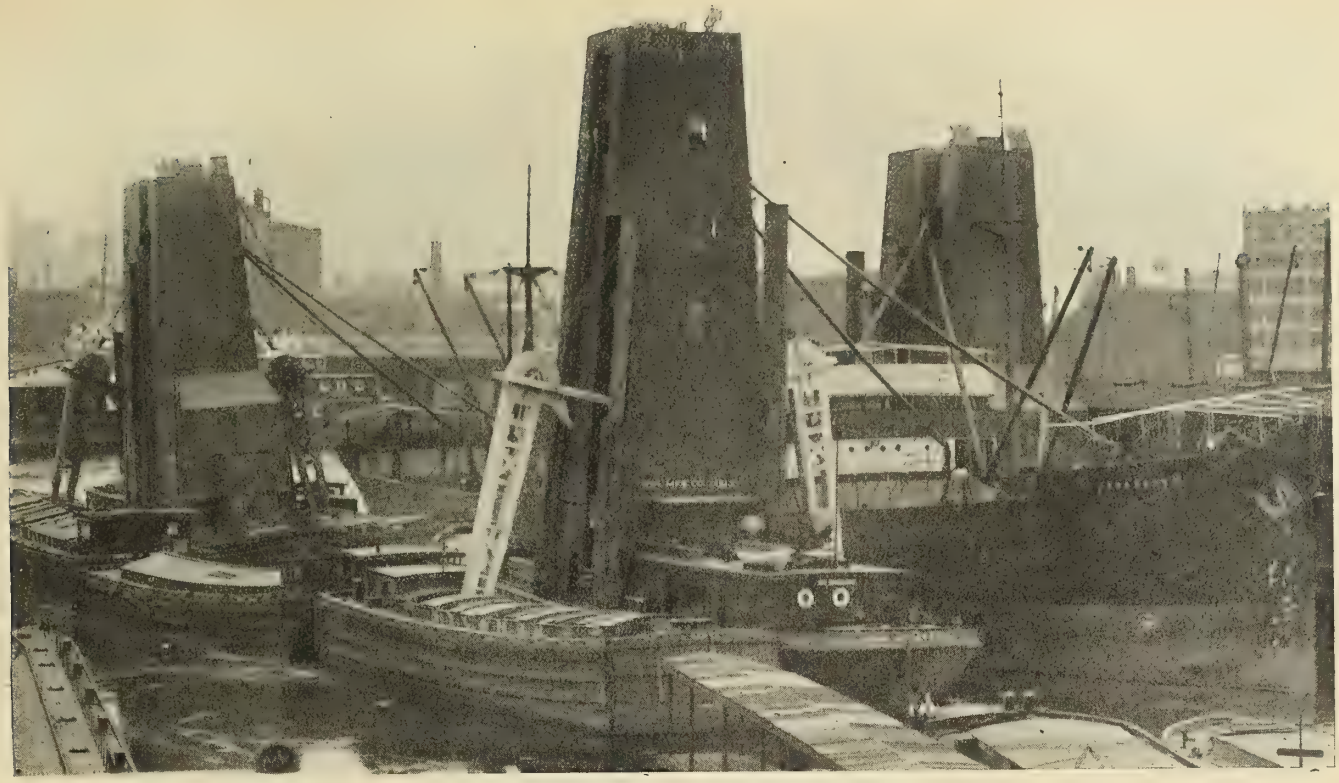


Fig. 2.—Floating Grain Transfer Elevators

Self-Unloading Fuel Lighters

Another important adaptation of self-unloading equipment is found in modern fuel lighters. The supply of fuel to steamers usually involves loss of valuable time as the ship must go from the unloading point to the coaling point and tie up to receive fuel. In many cases coal is delivered by lighters, simultaneously with unloading the freight, the coal being handled by wheelbarrows or by derricks and grab buckets; even in these cases it is rarely practicable to deliver a full supply of fuel while the steamer is discharging its cargo.

The *West Shore* lighter of the Pickands-Mather Company, which is equipped with self-loading machinery, was put into service for fueling that company's own ore boats as well as others using that harbor. This lighter is 170 feet long by 36 feet beam, with a hopper capacity of 1,000 tons. The unloading machinery has a capacity of 500 tons per hour, and as the large ore steamer takes only 250

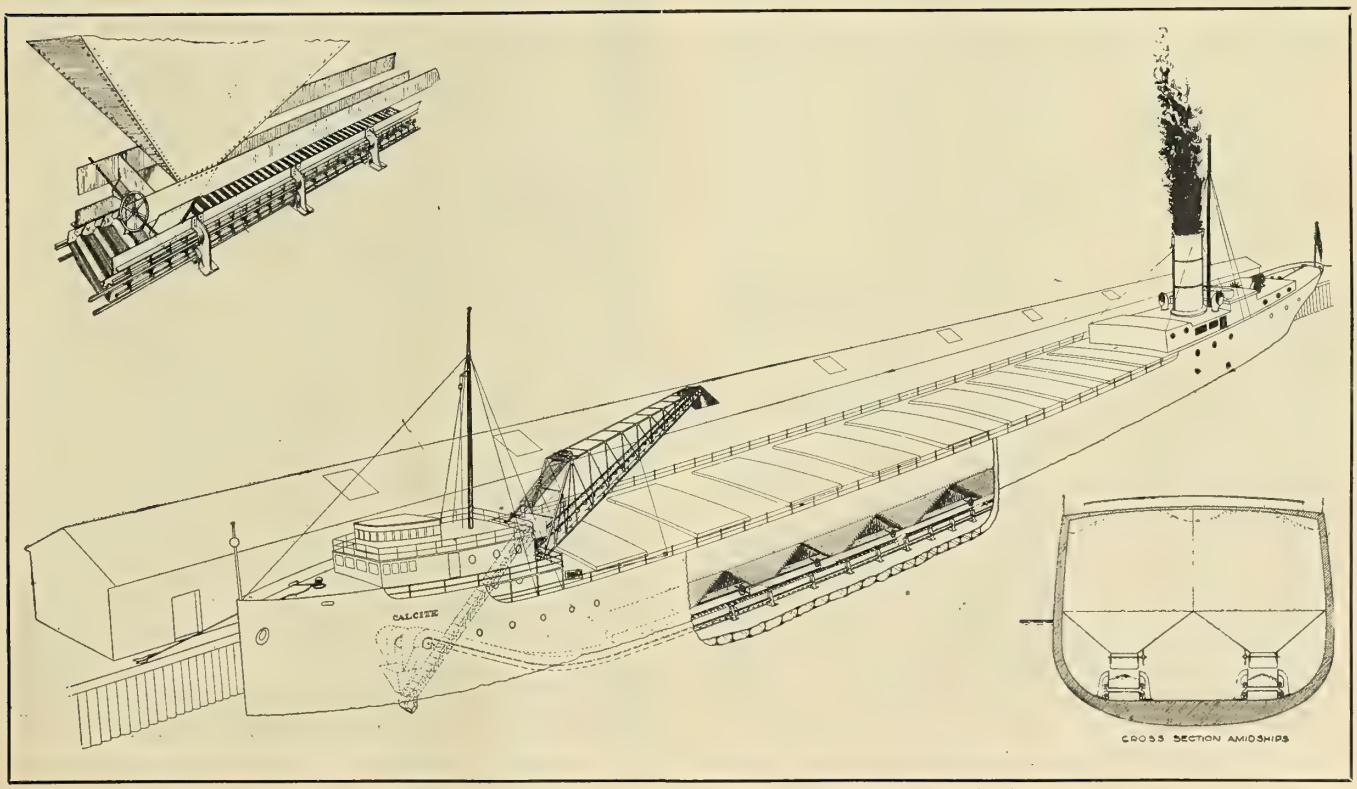


Fig. 3.—General Arrangement and Type of Conveyors Used on S. S. *Calcite*

to 300 tons of coal at a time, it can be supplied very quickly and may deliver coal, even with the steamer in motion. The unloading equipment consists of twenty-two reciprocating feeders delivering to two 42-inch steel pan conveyors, 57 feet long, placed tandem, these delivering centrally to a 48-inch by 30-inch vertical bucket elevator. This in turn discharges to a 42-inch steel pan conveyor, carried on a 50-foot revolving boom. The loading station which serves the *West Shore* is equipped with a 48-inch by 170-foot steel pan conveyor, with a capacity of 500 tons per hour. The conveyor extends under three track hoppers and the discharge end is pivoted to raise and lower.

The vessels of the various types described in this article were all equipped with conveying machinery designed and manufactured by the Stephens-Adamson Manufacturing Company, of Aurora, Ill. Some of the barges had previously been in service without unloading equipment, although the larger vessels were designed to accommodate the special hoppers and self-unloading equipment, which was installed during the construction of the vessel.

Thor Pneumatic Tools in Shipyards and Dry Docks

While pneumatic tools have been used in shipbuilding and dry dock work since they were first introduced, the importance of these small portable machines was never so fully realized as since the recent activity in the shipbuilding industry in this country.

The unprecedented demand from shipbuilders for pneumatic tools for various kinds of work resulted in a complete study being made by the Independent Pneumatic Tool Company, Thor Building, Chicago, Ill., of the service required and the tools best adopted thereto. This information, which is the result of numerous tests made with the Thor air tools and observations made by the company's experts, has been furnished this paper for the benefit of its readers.

It has been demonstrated that the size D-3 non-reversible piston air drill equipped with a No. 3 Morse taper socket is best suited for drilling and reaming on all bulkheads, shell clips and all close work inside of the hull. This machine is also used for all work in the intercostals, as well as for all 13/16-inch and 15/16-inch deck reaming.

The size C-4 non-reversible piston air drill equipped with a No. 4 Morse taper socket is used on all waterway bars, bulkheads, beam brackets and shell clips where closeness is not essential. This machine is also adapted for all reaming in shell work, taking the place of the heavier drills formerly used. It weighs only 40 pounds, and, like

Fig. 1.—No. D-3 Drill, Reaming 7/8-Inch Holes on Poop Deck of Ship

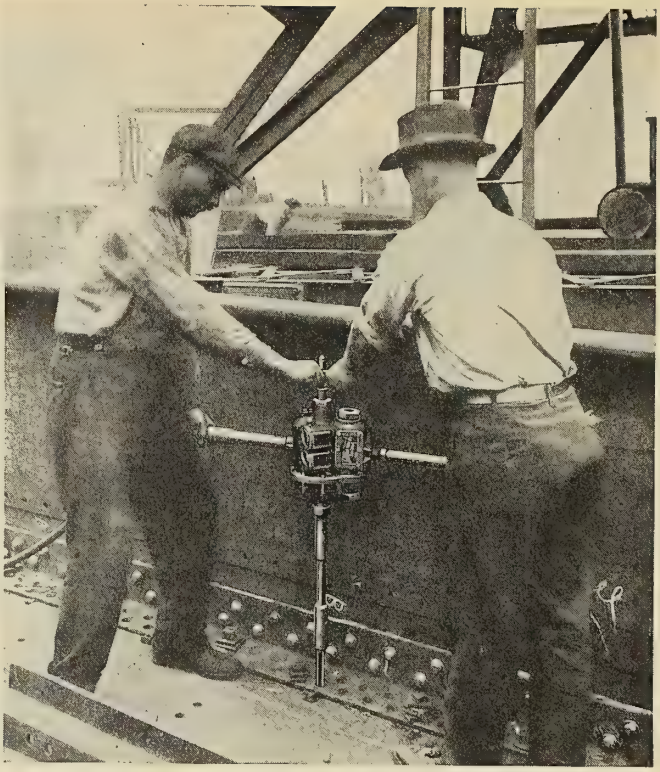


Fig. 2.—Size C-4 Thor Drill, Reaming 1-Inch Holes in Waterway Bars

Fig. 3.—Corner Drill, Reaming 7/8-Inch Holes Through Intercostals in Tight Places in Double Bottom

Fig. 4.—No. B-W Thor Drill, Boring 1½-Inch Holes in Oak Timbers for Launching Ways

size D-3 machine, is equipped with a special spindle permitting the use of oversize shanks and tangs on twist drills and reamers.

For boring out stern frame eyes and pintles, when the stern frame is in place the size "NN" compound reversible machine is used. All classes of work requiring a boring bar and flue rolling up to 5 inches in diameter in marine boilers can be performed with this motor.

The sizes E, F and G, small drills, are used by the plumbers, pipe fitters and in the sheet metal shops for all drilling and reaming bolt holes or rivet holes on flanges,

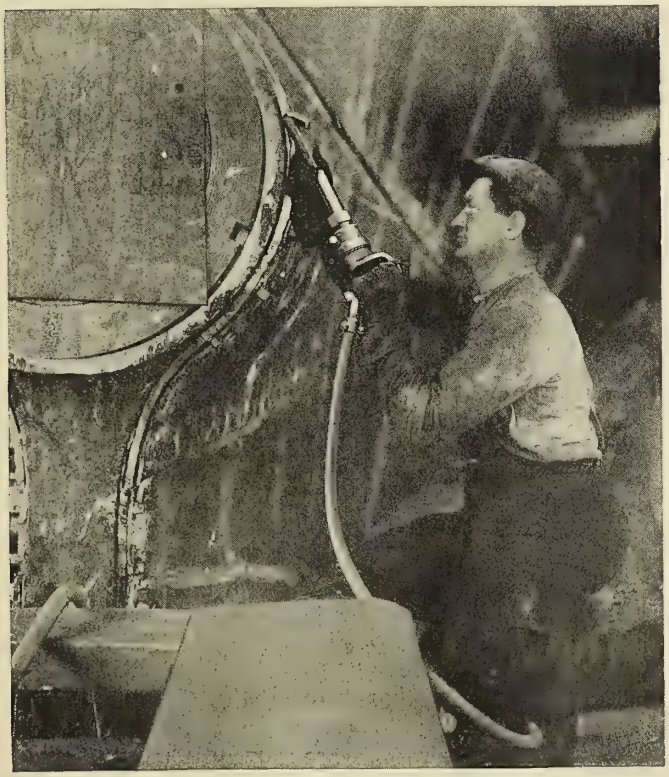


Fig. 5.—Chipping Boss Plate and Making Up Patch Bolts on Propeller Eye with Size B Chipping Hammer

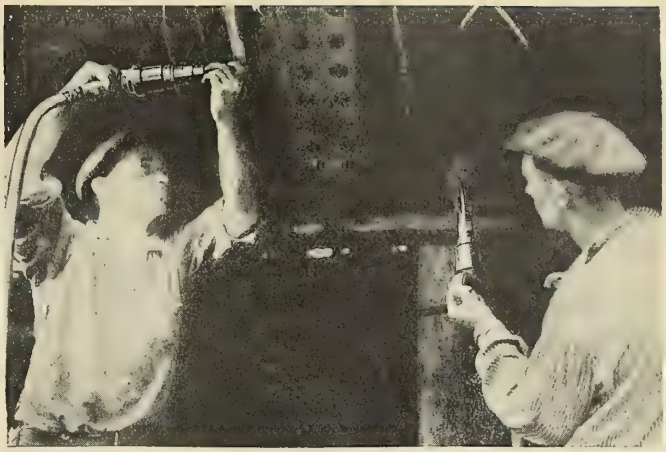


Fig. 6.—Two Size "N" Thor Tank Testing Hammers at Work

etc. These drills weigh only about 10 pounds and can be used in very close corners, and, although rated up to 9/16-inch capacity, they can be used for drilling ¾-inch and ⅞-inch diameter holes when they occur in a proximity of the work being done by the operator.

Special Machine for Close-Quarter Drilling

The No. 8 close corner drill is a very handy machine in all close-quarter drilling in water bottoms between frames, while the No. 9 is used for all kinds of close-quarter work

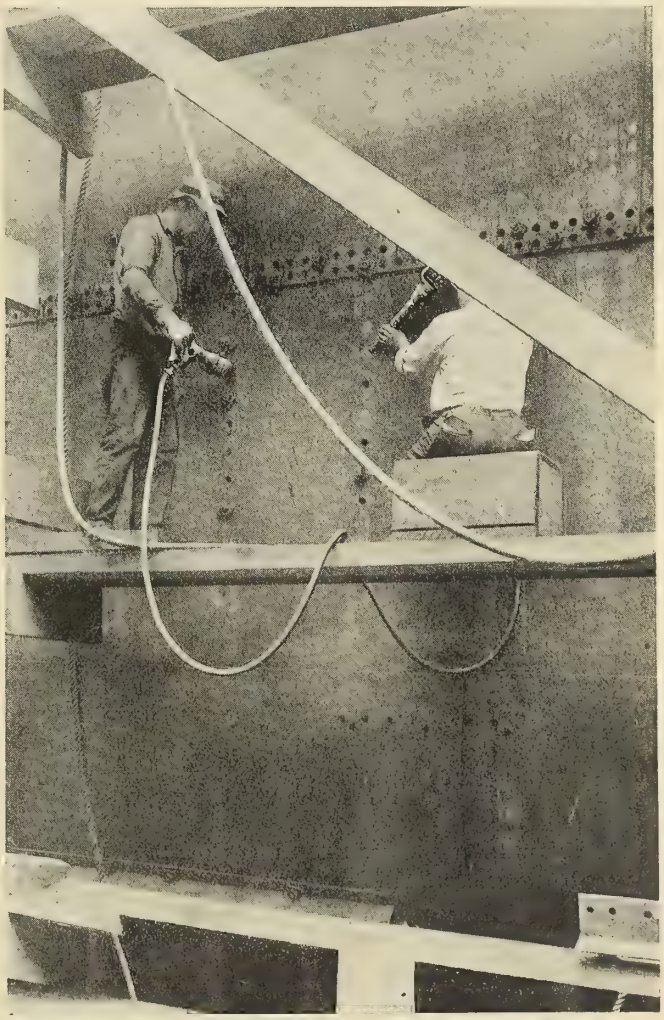


Fig. 7.—No. 60 Riveting Hammer, Driving ⅞-Inch Shell Rivets and No. B Chipping Hammer Chipping Heavy Work

in setting heavy engine frames, etc. It can also be supplied reversible for rolling the outer tier of flues where ordinary center-spindle drills cannot be operated.

In the marine boiler shops the size "BB" is used for staybolt drilling and tapping and running in staybolts and driving studs.

The size "BW" reversible wood-boring drill is adapted for all kinds of work up to boring 2-inch holes and general timbering about the stocks or launching ways or similar uses.

The No. 72 portable air grinding machine can be used with satisfactory results in surfacing all kinds of armor plates, turrets, etc., after the chipping hammer or the burner. It is also used for cleaning and squaring the

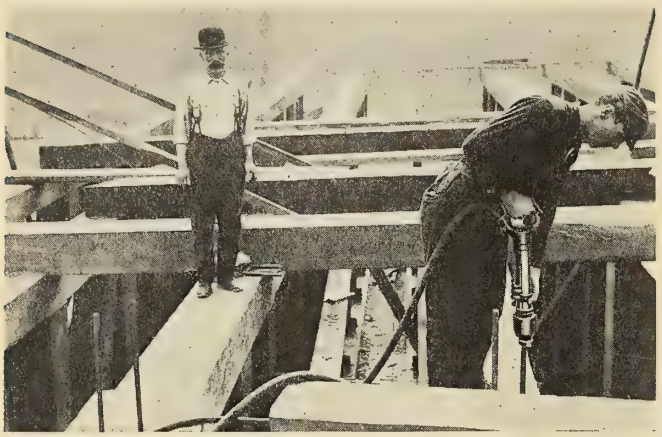


Fig. 8.—No. 90 Thor "Safety First" Riveter, Driving 3-Foot by 1 1-16-Inch Drift Bolts in Shipways

coping on channels, frames, beams, etc., after the burners are finished, and is a very convenient tool for finishing up work on all parts of the ship.

The size "B" Thor pneumatic chipping hammer is the lightest tool on the market capable of the heaviest shell calking and chipping. It weighs only 10¾ pounds and is suited to all-around cutting, scarfing and calking, while the size "NN" scaling hammer is particularly suited for tank testing work, being capable of performing the work of three hand testers.

The riveting hammers manufactured by this company are of the one-piece type, having a dropped forged barrel and handle which cannot come loose or leak air. The No. 60 equipped with an outside trigger is recommended for all classes of shell, tank-top and bulkhead driving and is considered a standard riveter for all classes of shipyard work, being light and short in length. The No. 90 with outside trigger is used in the marine boiler shop for steam-tight work. This hammer can be equipped with a "safety-first" rivet set retainer when so specified, making it particularly suited for driving drift bolts, spikes, etc., in the ways and stocks. The set retainer prevents an inexperienced operator from shooting the set out and losing same overboard.

THE NEW BATTLE CRUISERS.—Plans for the new United States battle cruisers call for vessels 850 feet in length with a displacement of 35,000 tons and a speed of 35 knots. The beam will be about 97 feet and the main battery will consist of ten 14-inch guns. The four new battleships authorized at the same time will be 624 feet long overall, 600 feet long between perpendiculars and 32,600 tons displacement. The main battery will consist of 16-inch guns.

NEW BOOKS FOR MARINE ENGINEERING

MARINE STEAM TURBINE. Fourth edition. By J. W. M. Sothern. Size, 6 by 9 inches. Pages, 555. Illustrations, 330. New York, 1916: D. Van Nostrand Company. Price, $6 net.

The development of the steam turbine during the last decade has brought more changes in modern practice of marine engineering than any other one factor. Not only is the steam turbine becoming practically the sole means adopted for propulsion of war vessels, but its application to merchant vessels is becoming widespread, especially since the application of reduction gears between the turbine and the propeller has been perfected. Bearing this in mind, no modern marine engineer can afford to ignore the turbine—in fact, he must not only be thoroughly familiar with its construction and the general principles underlying its operation, but he must be competent to take charge of a turbine plant and operate it economically. The book on steam turbines which Mr. Sothern has compiled gives a practical description of the two most common types of turbines used on board ship—the Parsons and the Curtis. It tells how these turbines are constructed, fitted and run under present practice. The text is fully illustrated with large diagrams and detailed drawings of the machines. The theory and mathematical discussion of the thermodynamic problems involved in turbine work are fully explained. The present edition of this book has been greatly enlarged, no less than ten sections, or chapters, having been added.

LAND AND MARINE DIESEL ENGINES. By Giorgio Supino. Translated by Engineer Lieutenant-Commander A. G. Brenner, R. N., and James Richardson, B. Sc. (Eng.) London. Size, 6 by 8¾ inches. Pages, 309. Illustrations, 300. Plates, 19. Philadelphia, 1916: J. B. Lippincott Company. London, 1915: Charles Griffin & Company, Ltd. Price, $3.75 net.

Comprehensive treatises on Diesel engines, especially of the marine type, are comparatively few in number, due mainly to the fact that the development of this type of engine up to date has consisted largely of experimental work, leaving the design in a state of transition, so that any discussion regarding it is apt to become almost out of date during publication of the information. Four-cycle Diesel engines, however, have already passed beyond the critical and experimental stages of their development and permit more extended treatment. Two-cycle engines of large power have not been brought to a stage of development where their commercial success is assured. Bearing these limits in mind, this book deals very exhaustively with both the thermodynamic and practical questions regarding the construction and operation of marine Diesel engines. The text is profusely illustrated with excellent detailed drawings, many of them in the form of large plates. These drawings and the formulæ will be very useful not only to the young engineer taking up practical work in oil engines, but also to experts as a book of reference. A section of the book which is of special value for reference is that dealing with the rules and classification societies for the construction of marine oil engines.

The book is divided into two parts, the first describing the general principles of Diesel engines, the fuels, thermodynamic cycles, efficiencies and the calculation of cylinder dimensions. The second part describes in detail the design and construction of various parts of commercially developed engines and accessories, and gives information regarding the tuning up and acceptance trials of the engines.

Letters from Marine Engineers

Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

Feed Water Heating

With the advent of the triple expansion engine came its legitimate accompaniment, the high pressure boiler, and with high pressures came the necessity of heating the feed water. The temperature of saturated steam of 175 pounds pressure absolute is 370.8 degrees F., while feed water is frequently at so low a temperature as 110 degrees F. We have then a cool current of water taking a devious course through the other water of the boiler, impinging in its wanderings against hot heating surfaces, subjecting them to sudden contraction or against columns of steam bubbles on their way to the water line, effecting their condensation and perhaps inducing foaming. In fact, a current of cold feed water must be rated as one of the worst disturbing elements that a boiler has to contend with.

In shell boilers, which have neither appliances for heating the feed nor means for producing a thorough circulation, a body of comparatively cold water settles at the bottom and does considerable mischief. The general double-ended boiler attains a length of about 20 feet. In the case of such a boiler, if the temperature of the water at the bottom be 150 degrees and the temperature of the upper portion of the shell be 370 degrees F. (corresponding to steam of 160 pounds gage pressure), the difference of expansion between the two opposite parts of the shell amounts to about 0.33 inch. The strains thus set up are well known to be the cause of many leaks and fractures.

With feed water heated to live steam temperature, such strains are entirely obviated. In some cases the feed water is not heated up to the live steam temperature, the benefits of such treatment being, of course, proportionately less.

For heating feed water three methods have been tried, namely:

Class A. Arrangements of pipes or flues in uptake.

Class B. Arrangements of feed coils surrounded by exhaust steam from receivers, or live steam.

Class C. Direct commingling of the steam with the feed water without the intervention of heating surfaces.

Devices in Class A have long been in use. The chief objections to them are: liability of the heating surfaces to burn from being fouled with scale, grease or other dirt, liability to corrosion from the effects of moisture, acids in the furnace gases, and so on, and also inaccessibility for effecting repairs.

The other two forms—Classes B and C—are the ones now most commonly in use, and it is not improbable that uptake heaters will be entirely discarded, if, indeed, such is not the case at the present time.

For Class B it may be said that the arrangement of tubes acts to a certain extent as a grease extractor, the grease adhering to the tubes, from which it may be moved periodically. With the increasing employment of oil eliminators on the exhaust pipes of engines, it is not likely that the feed water will contain much, if any, oil. Should the feed water contain any scale-making constituents, the hot tubes will precipitate and receive the same, and thus save the heating surfaces of the boiler. Against this class of heater may be noted its somewhat complicated structure, its expense and more or less inconvenience of cleaning and scaling.

Those forms of heaters under Class C are, in the author's opinion, the simplest of all, just as the old jet condenser was simpler than the modern surface condenser. By heating the feed water with direct contact of steam a smaller apparatus is made effective, since there is no transmission of heat through slow conducting metals. If the heater is to be employed in the double capacity of heater and scale precipitator, then there must usually be provided a series of plates or pans to receive the precipitate, the heater being opened at intervals and the pans removed for scaling. In this case there is probably but little saving in weight over Class B. The scale pans of Class C are somewhat more convenient for removal and scaling than are the tubes of Class B, and the matter of expense is probably in favor of Class C.

Since steam is used as the heating agent in two of the classes of heaters under consideration, it becomes important to inquire whether the heating should be accomplished entirely with live steam or partly with exhaust steam and partly with live steam. We shall first assume that one pound of feed water is heated up to the live steam temperature by the employment of live steam alone. Next we shall consider one pound of feed water heated up in successive stages by steam from the low pressure receiver, steam from the intermediate pressure receiver, and finally by live steam.

1. To heat one pound feed from 110 degrees F. to 370.8 degrees F., with steam of 175 pounds absolute pressure and temperature of 370.8 degrees F.:

Number of heat units to be imparted = 260.8.

Number of heat units to be surrendered = 855.6 x = 260.8 degrees F.

Number of pounds steam condensed = x = 0.3048.

Total pounds feed sent to boilers = 1.3048.

2. (a) To heat one pound feed from 110 degrees F. to 228 degrees F., with steam from the low pressure receiver, of 20 pounds absolute pressure and temperature of 228 degrees F.:

Number of heat units to be imparted = 118.

Number of heat units to be surrendered = 954.9 x = 118.

Number of pounds of steam condensed = x = 0.1235.

Number of pounds of augmented feed water = 1.1235.

(*b*) To heat 1.1235 pounds of feed from 280 degrees F. to 302.9 degrees F., with steam from the intermediate pressure receiver of 70 pounds pressure absolute and temperature of 302.9 degrees F.:

Number of heat units to be imparted = 84.15.

Number of heat units to be surrendered = 902.9 x = 84.15.

Number of pounds of steam condensed = x = 0.0932.

Pounds of augmented feed water = 1.1235 + .0932 = 1.2167.

(*c*) To heat 1.2167 pounds of feed from 302.9 degrees F. to 370.8 degrees F. with steam from boiler of 175

pounds pressure absolute and temperature of 370.8 degrees F.:

Number of heat units to be imparted = 82.61.

Number of heat units to be surrendered = $855.6\ x = 82.61$.

Number of pounds of steam condensed = $x = .0965$.

Total feed = 1.2167 + .0965 = 1.3132 pounds.

In Case 1 one pound of steam passed successively through the high pressure, the intermediate pressure and the low pressure cylinders. In Case 2, 1.2167 pounds of steam passed through the high pressure cylinder, 1.1235 pounds of steam passed through the intermediate pressure cylinder, and one pound of steam passed through the low pressure cylinder. Since, in all properly adjusted triple expansion engines, the work is divided more or less equally among the three cylinders, we may, for the purposes of comparison, assume that one pound of steam performs the same amount of useful work in each one of the cylinders through which it may pass. Then, in case No. 1, the work would be represented by 1 + 1 + 1 = 3. In case No. 2 the work done would be represented by 1.2167 + 1.1235 + 1 = 3.3402.

Placing the above results in tabular form we have:

	Heating by Live Steam Only	Progressive Heating
Total pounds feed sent to boiler	1.3048	1.3132
Number heat units surrendered to heat feed	260.8	284.76
Number pounds steam condensed to heat feed	.3048	.3132
Comparative work done in cylinders	3.00	3.3402
Work done per pound of feed	2.299	2.543

Gain by progressive heating, 10.6 percent.

Whether the increased economy to be anticipated by the adoption of progressive heating would warrant its increased cost is an open question. As to the absolute economy of feed water heating, it is not difficult to understand why the uptake heaters effected a saving, as the heat which they utilized would otherwise have passed up the smoke pipe and been wasted. Steam feed heaters were at first employed to relieve the boiler strains consequent upon the employment of cold feed water, and the resultant economy of the practice was a surprising discovery.

THOMAS J. ROGERS.

The Allen Dense Air Ice Machine

It was with considerable interest that I read the article by F. C. W. of his troubles with the Allen dense air machine, published in the July issue. He starts in with the admission that he had no experience with this type of machine, and that for a while he let well enough alone. It seems, after reading his article, that, according to his troubles with continued breakdowns, he got plenty of experience at the expense of many new parts, and, in my opinion, he could have saved himself a great deal of trouble and the owners of the ship the expensive repairs, even without having any previous experience on this special type of machine, for, after all, the Allen machine is in a sense similar to an engine in its construction, and most of his troubles were practically engine troubles. Certainly the expander cylinder is of the same principle and the compressor cylinder is of the same construction excepting the port passages through the slide valve.

Now, while I do not want to seem to be an unfair critic of the article by F. C. W., I do want to make it clear that from my eight years' experience with all the different sizes of Allen dense air machines, from the ½-ton to the 3-ton, I have found that the valves as originally designed and installed by the makers of the machines are correct, and give excellent results. Unless the measurements are changed by some inexperienced person they never could change. The expander valve cannot change, even by excessive wear, and only by excessive wear or planing down can the face of the slide valve in the compressor valve chest change the slightest. This would mean the shortening of the distance between the exhaust port edges due to the exhaust port cavity being on a radius, thus taking a little off the face could shorten the distance as mentioned. But this is now impossible on the new valves that are now made or any spares furnished for old machines, for this exhaust cavity is milled deeper and with square depth shoulders.

F. C. W. states that a new expander cylinder was installed and that when started things did not run right, and that he traced the trouble to the expander valve. Now, a 3-ton machine has two valves on the expander cylinder, a slide valve and a cut-off valve. Although he does not state it, I take from reading the article that he added ⅝ inch to the length of the cut-off valve; this would, if it was the original valve installed by the makers, change its length from 5 3/16 inches in length to 5 13/16 inches. Now, this would be a mystery to me how the machine could operate satisfactorily with this large change in the measurements of the valve. The proper settings for the expander valve of a 3-ton machine are: lower or slide valves, lead 1/32 inch; upper or cut-off valve closes or cuts off at 6¼ inches. With these settings the valves should give proper running results in so far as the settings are concerned. Three and one-half expansion is about what should be expected.

The machine when started has to build up the pressure of five atmospheres (60 or 70 pounds) in the system before she starts working. This is then taken by the compressor cylinder and compressed to 210 or 240 pounds (a ratio of 3 to 1 being about right between pressures). This heats the air. Heat that is stored up by the labor expended upon compression is partly removed by passing it through a copper cooling coil which is immersed in circulating water, the temperature being reduced to nearly that of the water. The air then passes into the valve chest of the expander, which is in construction very much similar to the usual steam engine equipped with a cut-off valve. The valves admit the compressed air (210 or 240 pounds) upon the piston to a certain point of the stroke and then cut off. The piston continues to travel to the end of the stroke, the air exerting pressure upon it (constantly diminishing by expansion). This takes out of the air a quantity of heat equal to the labor performed by the air in expanding. The result is a very low temperature at the end of the stroke. The return stroke pushes the cold air out into the system at a pressure of 60 or 70 pounds.

The expander helps the steam cylinder and the compressor takes the power. The expander cylinder cut-off valve must cut off the pressure at such a point that the expanded air at the end of the stroke of the piston is very nearly the same as the pressure in the system out into which it pushes it. If it were of much higher pressure it would at exhausting warm up again by exerting its remaining power in producing velocities and friction inside of the apparatus.

Many troubles can be avoided in the operation of the dense air machine if they are given the proper care. A few points on their operation that will help are given here.

Do not overtax the capacity of the machine. The amount of piping used in refrigerating the storage boxes or rooms should be such as to give about one square foot of outside surface of piping to three square feet of interior room surface (ceiling, sides and floor: interior divisions not counted) for the rooms which the cold air enters first. For later rooms 2½ square feet, and when

very large amount of room is to be cooled the last room should have about one square foot of refrigerating surface for two square feet of interior room surface. It is best to have the cold air enter the room first near the ceiling, especially in the later rooms, so the air currents may ascend to near the ceiling. The rooms that are to have the advantage in being kept cold should have the cold air first.

The two most vital points, to be sure, are, first, that your circulating water through your coil (and water jacket around the compressor cylinder) is properly circulating. An item in connection with this is to see that this piping through which the circulating water is drawn from the sea and delivered to the cooling coil is well lagged, especially if it has to come through warm compartments, such as boiler rooms over boilers. Next, that when for any reason work is being done on any part of the system or valve chests or cylinders, great care is given to keeping the interior free from dirt and grit. A small scratch or score on the face of the compressor valve will very vitally affect the proper work of the machine. These valve surfaces must be tight and a lubricator installed to give them an occasional drop of oil. The oil must be of ice machine class, able to stand heat and cold. A good mineral oil from which paraffin is removed by freezing is suitable. All joints should be very carefully made, as air leaks do not take up, but get worse in time.

Once every three months a pressure of 60 to 70 pounds should be put on the pipes, and every part of every joint and every bolt head should be carefully inspected and tested by putting on a lather of soap with a brush, so that any leak will be easily detected by formation of air bubbles. These leaks must be stopped in a permanent manner. Joints are generally made with thin rubber gaskets and the joint painted with litharge and glycerine.

An occasional draining out of the bottom of the coils in the refrigerating rooms helps.

The whole piping system should once a year be steamed out and then blown out.

The machine should run at an average of 50 to 150 revolutions, according to the number of boxes or rooms being cooled or the volume of air being used.

All stuffing boxes on the machine piston rods should be well packed and kept tight. Be careful not to score the rods. Every tiny leak about the machine means loss of efficiency in refrigeration.

The piston leathers of the compressor and expander cylinders should last ordinarily about two months. They can be resoaked in castor oil and when swelled used over again. There should be a steel forming die (similar in construction to the piston in which the cup leathers are used), in which a spare set of leathers should be tightly clamped and formed. This die with the leathers in should be submerged in a can of castor oil. This treats the working edges of the leather to a soaking bath in the oil and keeps the main part of the leather that is clamped in the die or on the piston dry, the feature of this being that when the spare leathers are placed in use in the machine they will not require constant following up to squeeze out the oil and take up the slack.

The leathers should be made from oak-tanned leather slightly less than 1/8 inch in thickness and cut 5/8 inch to 3/4 inch larger in diameter than the cylinders, according to size. When these leathers give out, trouble will be experienced with a loss of pressure. Sometimes the high pressure decreases in relation to the low, and sometimes just one cylinder may lose pressure and the system shows a loss of cold.

The clearance of the setting of the primer pump that makes up the air leaks is also a very important item. It should be the very least possible with regard to safety in striking. About 3/64 inch is right. The clearance in any of the cylinders of the air part is very small, not over 1/8 inch, so that very little change is permissible in the wearing parts and they must be very frequently checked up. When removing and replacing the nuts on the piston rods when putting in leathers, the unscrewing of the rod or least movement of it in its crosshead must be guarded against. I think the change of these small clearances is probably what caused the breakage of the piston and the crosshead mentioned by F. C. W. C. H. W.

Feed Pump Valves

There is a matter concerning the effective lift allowable to feed-pump valves which is a case where practice contradicts theory.

The engineer to whom $\frac{\pi d^2}{4}$ and similar symbols concerning the values of the circle are familiar mysteries has always been through the demonstration that the lift of a valve should be 1/4 d. to give equal opening. Now, while the truth of this is not called into question, the expediency of allowing this amount of lift to every valve, irrespective of conditions, is a matter for question. Every valve of whatever type causes a loss of efficiency due to a factor impossible to do without; i. e., that of friction. The change in direction given to the flow of fluid causes a loss of head, and in the case of a feed pump an increased pressure to overcome. The impediment of the valve seat has the same effect. For the last reason alone at least 25 percent, and more often 33 percent, must be subtracted from theoretical lift for physical reasons.

The trouble with text-book formulæ is that in no case can they be applied except in the light of practical experience. They are absolute knowledge when of the $\frac{\pi d^2}{4}$ type, and most formulæ of a practical order involve an empirical constant or factor of ignorance based upon actual performance of known result.

The designer of feed pumps pays more heed, like all hydraulic engineers, to the question of velocities rather than simple displacement volume. For example, in centrifugal pumps the whole question is one of velocity, not of direct pressure. A centrifugal pump is the only type which will run with less horsepower when the delivery valve is closed and involves no danger from excessive pressure to pump or pipe line. The reason is obvious. Under these conditions the impeller revolves as a solid flywheel and no work is being done other than rotation. Speed in a centrifugal pump is based upon 10 feet per second flow, and most simple centrifugals are most economical at this speed. In other words, the speed of the extreme edge of the impeller is 10 feet per second, and a greater or less speed usually results in impaired efficiency. To obtain the quantity passed per minute it is merely necessary to calculate cross section of delivery, multiplying by 10 and by 60; the result is displacement of pump. Another view of a centrifugal pump is that it is a booster, and high lift centrifugals have the boosting feature in stages.

The bad feature of many common, simple centrifugals is that they absorb more horsepower with a low head and a consequently greater volume than when a higher head and lessened flow are the conditions of operation. For maximum efficiency it is necessary that the designed head and speed be kept constant. With a displacement pump, on the other hand, power absorbed is directly proportional

to lift and to close delivery with pump running may lead to disastrous results. For this reason relief valves are necessary and invariably fitted in the pipe line or adjacent to the pump.

To return from the velocity pump pure and simple to the more usual type, a reciprocating boiler feed pump of the duplex or other type usually has the delivery valve area more or less in accordance with the plunger area. This means that the velocity of flow through the pump valves is more or less the same as that imparted by the plunger; it is in a reciprocating pump of any description a series of squirts and not a steady flow.

Another matter is that to be on the safe side the normal feed pump is much in excess of the duty required to furnish sufficient water for boiler evaporation. In fact, with feed pumps on the main engine at least 75 percent of their stroke is not pumping at all; in some cases it is forcing air into the boilers if the gland be not unduly tight. It is not overstating facts to say that the majority of feed pumps fitted are capable of supplying up to six times the normal feed as a maximum quantity. Most duplex pumps are rated on a moderate speed, which may safely be very much increased. The catalogue duties are based upon piston speed; in other words, their maker's list them not from a displacement, but from a velocity point of view.

Feed pumps of the type indicated are provided in most instances with small, flat valves, several in number, on both suction and delivery sides. If these valves are given theoretic lift the area of opening to flow leads to shock conditions in feed pipes. In the case of main engine pumps from easily realized conditions the shock stress in the pipes is greater still, and few are the steamers so fitted which survive the passage of years without repaired feed pipes.

If the lift of the valves be reduced and the delivery area be lessened the plunger of pump works at an increased pressure and the velocity of flow through valves is increased. Such restriction of flow tends to lessen shock on pipes. Wherever feed pipes vibrate unduly it is pretty safe to reduce lift on pump valves. Experiment can determine the safe lift, and experiment alone; it is as well, though, to put a pressure gage on pump chamber to ensure that conditions resulting are not too severe.

Bad cases of pipe shock have been cured by adjusting the valve lift to the thickness of a post card, and this without unduly stressing pump.

The smaller lift equalizes the feed water, which then proceeds in regular increments, and not in sudden large gulps. Want of this simple expedient has frequently led to the substitution of a specially designed large slow and deliberate pump of an expensive type to replace existing gear fully equal to all demands had the conditions been properly analyzed. In practice it will not be denied that most check valve regulation on boilers is severe upon the pump. Half a turn to check valve is usual. This regulation of feed effects results at the expense of shock to feed pipes. This at least is the present contention. A steadying effect is thus obtained at the wrong end of the system, which by adjustment of lift on the pump valves might have been more properly obtained at the beginning and not the end of the flow. The noise and vibration only too often found, which is a source of worry and discomfort to the engineer on watch, can be effectively altered far the better in a large number of cases by diminishing the lift of the pump valves. If, therefore, feed pipes vibrate unduly it is as well to overhaul the lift of the delivery valves. In a number of instances a complete cure has been effected by a reduction in lift.

The whole question of valve design, whether stop, check or when unadjustable, as in pump valves at work, can do with revision. Flanges designed more to save metal than give rigidity and spanner clearance are too much in evidence. So familiar a mechanical accessory, having years of precedent to fix type, has led to neglect of overhaul from the designer's end. Few are the valves which one comes across that cannot be adversely criticised; starting with the hand wheel and ending with the joint faces, there is ample scope for improvement. Extra work is put where it is least necessary often enough, as in a highly polished hand wheel which has to be served with yarn before a satisfactory grip can be obtained. Flange faces are made smooth so that the joint is less secure; a wire feed in machining is preferable to flange and a distinctly rough hand wheel. Bolts and nuts are cheap enough to substitute six or eight for the too frequently noticed four. Smaller bolts and more of them are needed with the yielding type of flange in gun metal, which is a perpetual sore place, not to mention ⅜- or ½-inch valves with oval flanges and two bolts.

The designer should be more generous in spirit in the weight of metal allowed. Most of the troubles experienced are impossible to effectively remedy when the job has been made up and is in being, causing daily annoyance to the engineer. The question of weak flanges alone has been a gold mine to the maker of patent packings and jointings. While the amount of skin lost from knuckles in the course of a year would cover an ordinary steamer's deck, laid (as the statisticians put it) end to end, from insufficient flange area and slipping spanners. One-thirty-second turn for each adjustment of the spanner to the nut is slow and wearisome work, and only too rarely are snugs fitted to the bolts. In small valves the wheels are too tiny for a big fist. There is a limit microscopically in this direction, while in large numbers of cases a wheel spanner whose use is only too common testifies to the insufficient size of the wheels in larger sized valves.

The critcisms do not apply universally, since there are makers who exclusively deal with valves. Some of these turn out a decent article, but the ideal valve is yet to seek. Vast numbers of such fittings for boilers and elsewhere are the poorest of goods marketed for sale only. To protect their customers many engine firms make their own valves, and, since design is not a specialty confined to a few makers only, it is hoped the remarks here tendered may serve to give a pause for reflection and lead to better things. If the spirit of rational criticism is once evoked and draftsmen and others responsible start to look upon existing practice with a critical eye there is little doubt that remedy will be effected. Where danger to life and limb are involved a small extra cost should not be allowed to stand in the way of safety first, which is a policy we all agree to subscribe to in spirit. No precaution is too costly to obviate troubles where risk is assumed daily, as where steam pressure is carried and where the remedies are known and easily applied it leaves little excuse after the event, if and when it happens.

A. L. HAAS.

London.

TWO HUNDREDTH ANNIVERSARY OF BOSTON LIGHT.—A small bronze tablet, bearing the inscription, "Boston Light, built at this place by the Province of Massachusetts, was first lighted September 14, 1716, Old-Style; destroyed 1776 and rebuilt 1783," and in small letters beneath, "This tablet has been placed by the United States Lighthouse Service, September 25, 1916, in commemoration of the two hundredth anniversary of the first lighthouse in America," was unveiled on September 25 at Boston Light Station at the entrance to Boston Harbor, Massachusetts.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding will be Answered in this Department

CONDUCTED BY H. A. EVERETT *

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so. Indicator cards taken from marine engines will be carefully analyzed, and defects pointed out, and the horsepower calculated, provided complete data are sent with the cards.

Defects in Indicator Cards

Q.—The inclosed indicator cards are from a small twin-screw steamer. Will you kindly make an analysis of the cards? It appears that the defects shown have always existed since the ship was built, and I am anxious to have your opinion as to the alterations that should be made to make the engines more economical. E. B. E.

A.—The high pressure cards are as good as one would wish. It is difficult to say just what may cause the disturbance in the admission lines of the low pressure cards. The lead appears somewhat insufficient for the bottom cards, and if this were increased a slightly better card would probably result. The bump in the middle of the admission line is probably merely a normal effect of the high pressure release into the receiver (assuming that this is a quarter crank engine). It is doubtful if the cards can be much improved upon. Oscillations in the admission line often appear in cards taken with a weak spring and are due to vibration of parts of the indicator.

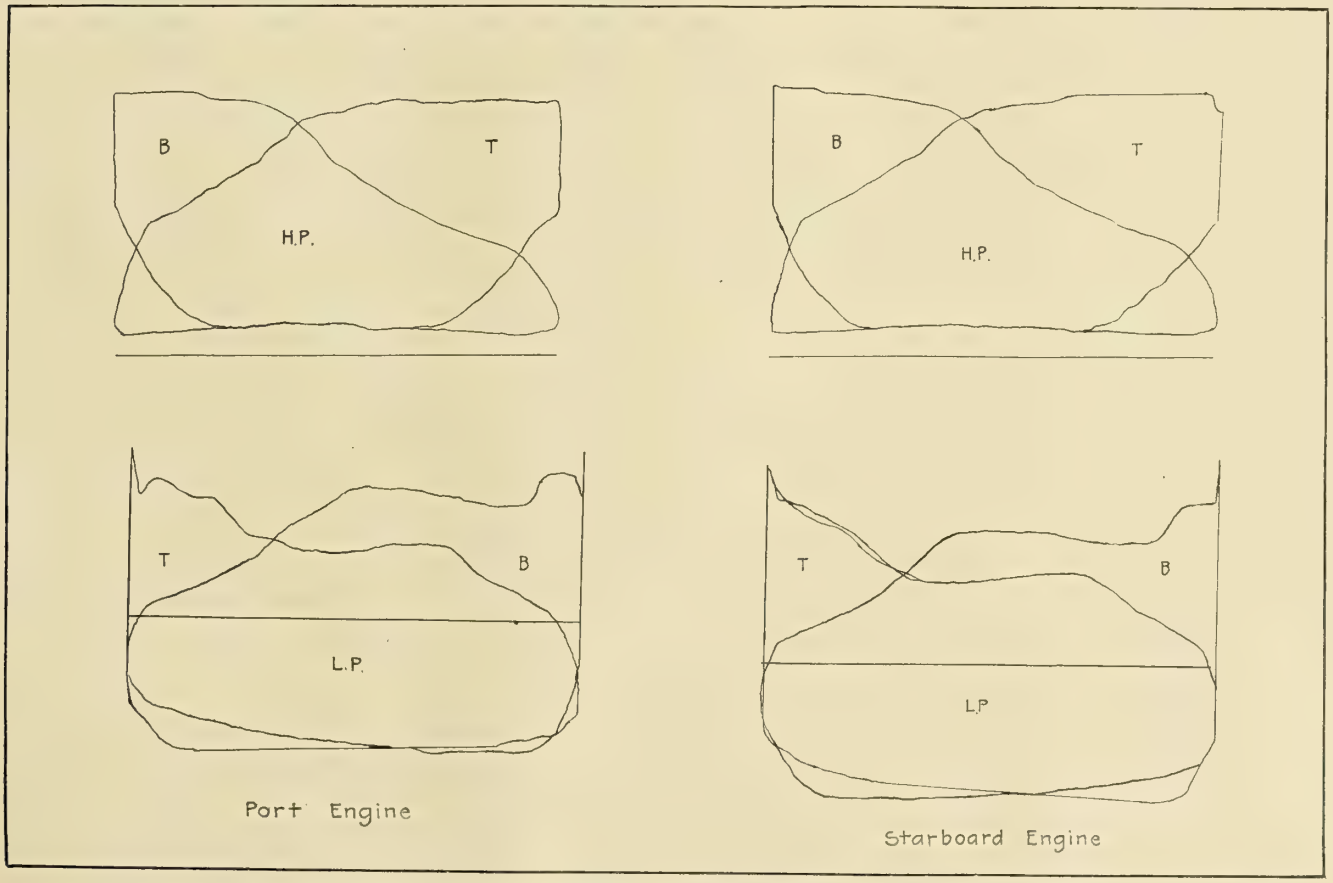
* Professor of Marine Engineering, Post Graduate Department, United States Naval Academy, Annapolis, Md.

Absorption of Water by a Gas

Q.—Can you give me a formula or table for the weight of water that a gas at any temperature and pressure will absorb when in contact with the free surface of the water? I have a formula that gives negative values for the weight of water that pure air will contain at any pressure and temperature when I substitute the pressure and temperatures of saturated steam—why is that? R. D. K.

A.—The question is too vague for a definite answer. If you will send in a specific problem, I will try and give the solution. There are tables published for the amount of water vapor which air will sustain without condensation, and the following is abstracted from one of these:

Temp. of air, degrees F.	Weight of water vapor per cubic foot, pounds
32	0.000304
40	0.000410
50	0.000587
60	0.000827
70	0,001145
80	0.001564
90	0.002121
100	0.002850
200	0.02976
212	0.03738



Indicator Cards from Compound Engines; 13 x 30 x 24 Inches on Twin-Screw Steamer, Boiler Pressure, 155 Pounds per Square Inch; Vacuum, 24 Inches

Books on Wooden Shipbuilding

Q.—Would you kindly inform me if there is a treatise on modern wooden shipbuliding similar to Holms' "Practical Shipbuilding" of steel vessels? Please recommend also books on shipyard management. E. S.

A.—There is no modern treatise on wooden shipbuilding. The best work on this subject is the classical one by Thearle entitled "Naval Architecture," published many years ago, but still good for wooden ship construction. This is not his treatise on "Iron Shipbuilding." The publishers are G. P. Putnam's Sons, 2 West 45th street, New York.

I know of no book that deals specifically with shipyard management. An excellent book which covers cost estimation and some phases of modern planning and routing is "Estimating the Cost of Work," by W. B. Ferguson, published by the Engineering Magazine Company, New York.

Power for Driving Propeller

Q.—Will you please advise if there is any simple formula fairly accurate for calculating the horsepower required to turn a propeller of given diameter, pitch and blade area a given number of revolutions? P. P.

A.—There is no formula involving only the variables you mention which will permit the estimate of the power absorbed by a propeller (the power delivered by the engine to the propeller) with any reasonable accuracy, as the data are insufficient in themselves to determine its action. Slip is a function of prime importance in propeller operation and must be taken account of either directly or indirectly (as speed) in any expression for the prediction of power. For example, a given propeller drives a ship at a definite speed when turning at certain revolutions per minute; now, suppose that, due to additional resistance, such as towing or added displacement, the same revolutions per minute drive the ship only three-quarters as fast, the indicated horsepower to maintain this same revolutions per minute would have increased and nearly proportional to the slip increase.

Most of the design or analysis of propellers is now done by means of the results of experiments on model or full-sized propellers, as published in the books of Taylor[1] or Dyson[2], and these take account of all the variables which affect actual propeller performance. Admiral Taylor has recently published* the following expression as representing approximately and through the range of propellers commonly met with, the horsepower absorbed by a three-bladed elliptical contour propeller, and this is the best single expression of propeller performance available:

$$P = \frac{0.88 + \frac{0.69}{a} + \left(1.3 + \frac{10.3}{a}\right) t}{1 - s} \left(\frac{p R}{1{,}000}\right)^3 \frac{d^3}{p}$$

in which the letters have the following significance:

P represents horsepower absorbed by propeller (the brake horsepower of engine).
d represents diameter of propeller in feet.
p represents pitch of propeller in feet.
a represents pitch ratio, which is $\frac{p}{d}$.
R represents revolutions per minute.
s represents real slip (not apparent slip).
t represents blade thickness fraction (thickness of radial blade section at axis, if lines of face and back are extended, ÷ diameter).

The effect of the blade thickness fraction t is of minor importance, and if we accept a value of 0.06 for t, which is reasonable for general practice, the above expression simplifies into the following:

$$P = p^2 \left(\frac{R\,d}{1{,}000}\right)^3 \left[\frac{0.96 + \frac{1.31\,d}{p}}{1 - s}\right]$$

Value of slip for best efficiency should lie between 0.20 and 0.35.

Four-bladed wheels will take approximately 1.25, and two-bladed wheels approximately .75 of the above.

[1] Speed and Power of Ships. D. W. Taylor.
[2] Screw Propellers. C. W. Dyson.
* Paper before International Engineering Congress, San Francisco, 1915.

Effect of Throttling of Superheated Steam

Q.—Does superheated steam retain its superheat after excessive throttling? On ships where steam at boiler pressure is supplied to the auxiliaries more or less throttling is to be found, except perhaps only in the case of the feed pumps; the ballast pump, for instance, will usually be working with the steam stop valve only slightly opened; assuming now that the steam in the main at the pump is 170 pounds pressure and is superheated to 300 degrees C., will it still be superheated if pressure in the steam cylinder is reduced to, say, 100 pounds by throttling? If so, please give rule for finding temperature after throttling. Where can results of tests covering this be found? G.

A.—The interesting phenomenon of throttling in the thermodynamic meaning of the term occurs when there is an expansion without the addition or subtraction of heat (adiabatic action) under such conditions that the energy available from unrestricted expansion is used up in overcoming the internal resistances. The action is adiabatic, but not isoentropic, and the solution of problems is made possible by the fact that it is an adiabatic process; i. e., that no heat has been added or taken away; that no work has been done, and therefore that the heat contents is the same at the end of the operation as at the beginning. The actions met with in actual practice occur so quickly that there is no appreciable error in assuming them adiabatic, and it makes no difference whether the steam is saturated or superheated at the start. It will have the same heat contents at the lower pressure that it had at the start, and will therefore be in a dryer or more superheated condition at the finish than in the high pressure condition.

In the problem given, steam at 170 pounds absolute, superheated 540 degrees F. (300 degrees C.), has a heat contents of 1,470 British thermal units (temperature = 910 degrees F.) Now, as no heat enters or leaves the steam and none is transformed into work, this is the heat contents at the lower pressure of 100 pounds, and it is only necessary to find from the steam tables or diagrams the condition of the steam at this pressure and heat contents.

It is superheated 575 degrees; the temperature, therefore, is obtained by adding the number of degrees of superheat to the saturation temperature of the steam at 100 pounds pressure absolute, or 328 degrees + 575 degrees = 903 degrees F.

References for experimental work on throttling are difficult of access, as the work of Grindly, Griessman, Peake, Joule and Kelvin are available in the original papers only, but an excellent discussion of the whole subject is given in Goodenough's "Principles of Thermodynamics," pp. 268-282 (published by Henry Holt & Co.). The solution of problems, however, is made from tables or diagrams of the properties of steam, such as Peabody's or Davis and Mark's.

Laying Up Boilers

Q.—I am going to lay up a couple of boilers for four months. Would you recommend using boiler compound in the water left in them? F.

A.—No. Run the water through an evaporator if possible and fill completely with evaporated water, taking care to see there is no excess alkalinity (over ½ percent) and that the boilers are filled full; also that the zincs are in good condition.

Shipbuilding and General Marine News

Contracts for New Ships—Marine Terminal Improvements—Recent Launchings—Improved Appliances—Personal Items

Steel merchant vessels building or under contract to be built in private American shipyards on October 1, according to builders' returns to the Bureau of Navigation, Department of Commerce, number 417 of 1,454,270 gross tons. On June 30 Lloyd's Register reported 439 steel merchant vessels of 1,540,118 gross tons under construction in British shipyards. The American returns cover contracts on which work has not begun, while Lloyd's returns cover only ships on which construction has actually begun. Although British yards have increased their merchant work, the delivery of engines and machinery is slow, and at present the completed output of American and British yards are about equal. During September, American yards finished 19 steel merchant vessels of 46,608 gross tons and made new contracts for 47 steel merchant vessels of 208,686 gross tons, about half of which is for Norwegian owners. The month's new contracts equal all the merchant steel tonnage in the United States building or under contract on July 1, 1913, and exceed that on July 1, 1914.

Shipbuilders expect to launch during the current fiscal year 326 vessels of 998,035 gross tons, and in the fiscal year ending June 30, 1918, 91 vessels of 456,235 gross tons. These dates of launching, of course, are subject to the usual allowances for delays.

Shipbuilding Contracts

The Navy Department, Washington, D. C., opened bids on October 25 for four battleships (price within $11,500,000 each) and twenty torpedo boat destroyers (price within $1,200,000 each). In spite of the increase in the cost of shipbuilding the Department was successful in receiving bids for all classes of these vessels within the cost limit set by Congress. Bids were received from the New York Shipbuliding Company, Camden, N. J.; the Fore River Shipbuilding Corporation, Quincy, Mass.; the Newport News Shipbuilding & Dry Dock Company, Newport News, Va.; the California Shipbuilding Company, Long Beach, Cal.; the Seattle Construction & Dry Dock Company, Seattle, Wash.; Bath Iron Works, Bath, Me., and the Union Iron Works, San Francisco, Cal. It is considered probable that two of the four battleships (*Colorado, Maryland, Washington, West Virginia*) will be built by the Fore River Shipbuilding Corporation and two by the Newport News Shipbuilding & Dry Dock Company.

Inquiries have been made among Atlantic coast shipyards for the construction of more than fifty ships for 1918 delivery, and actual contracts for 1918 delivery have been placed with shipyards on both the Atlantic and Pacific coasts.

The Seattle Construction & Dry Dock Company, Seattle, Wash., has received a contract to build three steamers for 1918 delivery.

The Sun Shipbuilding Company, 1428 South Penn Square, Philadelphia, Pa., has received a contract to build two 10,000-ton freight steamships for the Shawmut Steamship Company, Boston, Mass.

The Hanlon Shipbuilding Company, Oakland, Cal., has received a contract from the Western Fuel Company, San Francisco, Cal., to build a 3,500 ton auxiliary schooner.

The Standifer-Clarkson Company, Astoria, Ore., has received an order to build a 250-ton Diesel-engined ship to be known as the *Maid of Douglass*.

The Heath Shipbuilding Company, Portland, Ore., is stated to have received contracts to build six auxiliary schooners for Norwegian interests. These vessels are to be 266 feet long with a deadweight capacity of 3,000 tons.

The Washington Shipping Corporation, Seattle, Wash., states that work will be begun in November on its first vessel. The company has several auxiliary wooden schooners nearing completion at its Harbor Island plant.

The Navy Department, Washington, D. C., will receive bids on November 1 for four scout cruisers and twenty-nine submarines.

The Navy Department, on December 6, will receive bids for building four battle cruisers.

W. G. Abbott, Milford, Del., is building a wooden steam lighter for the Baltimore & Ohio Railroad Company, Baltimore, Md.

The Benecia Shipyards, Benecia, Cal., have received a contract to build a 200-foot river steamer to cost $130,000.

The Olympia Shipbuilding Company, Olympia, Wash., has been organized, and is reported to have received contracts to build four auxiliary schooners, each about 290 feet long.

The Bethlehem Steel Company, South Bethlehem, Pa., has received an inquiry from the Argentine Government covering the construction of a fleet of merchant ships at a cost of approximately $25,000,000.

The Isthmian Canal Commission, Washington, D. C., will soon call for bids for the construction of two colliers authorized by Congress, to cost not more than $1,500,000 each.

The Sharptown Marine Railway Company, Sharptown, Md., has a contract to build a steamer 163 feet long for the White Shipping Company, Laurel, Md.

The Gray's Harbor Shipbuilding Company, Aberdeen, Wash., has received a contract to build two power schooners for the Gaston, Williams & Wigmore Steamship Corporation, New York.

The American Car & Foundry Company, Wilmington, Del., has received contracts to build wooden boats exceeding 20,000 gross tons.

The Pacific Steamship Company Seattle, Wash., is planning the early construction of two 20-knot passenger and freight steamships to cost about $1,500,000 each. This company is the new name of the Pacific Coast Steamship Company and the Pacific-Alaska Navigating Company, which have been combined under one corporate head. The president of the new company is H. F. Alexander, Tacoma, Wash., and the manager is A. F. Haines, Seattle.

The Greenport Basin & Construction Company, Greenport, L. I., will build two submarine chasers 40 feet long, one to be used at each end of the Panama Canal.

The Pusey & Jones Company, Wilmington, Del., has received a contract to build four more steamships for Norwegian owners.

The Moore & Scott Iron Works, San Francisco, has received an order from B. A. Sanne, of Christiania, Norway, for a 9,400-ton cargo steamer fitted with Curtis geared turbines and Scotch boilers.

According to the Oakland Chamber of Commerce approximately $50,000,0000 worth of work is now being done or has been contracted for by Oakland shipbuilding yards. One-sixth of the iron and steel shipbuilding in this country is being done on San Francisco Bay. One-fourth is on the Pacific Coast.

Thirty-seven ships, with a tonnage capacity of 292,000, of which eleven are wooden vessels of the class of semi-Diesel auxiliary power propellers, with a tonnage of 77,000, are being constructed in the Pacific Northwest, according to a report by W. B. Henderson, United States commercial agent at Seattle. The steel vessels, twenty-six in number, have a capacity of 215,000 tons, and of this number four are contracted for by the United States Government. The value of vessels under construction and contracted for aggregates $32,000,000.

Six auxiliary wooden schooners for Norwegian account are reported to have been booked by the Heath Shipbuilding Company, of Portland, Ore. Delivery of the first vessel is to be made in ten months, the second in eleven months, and one thereafter every sixty days, with the sixth ship ready to turn over to her owners in nineteen months from the date of the contract. The vessels will be of the topmast type, 266 feet long, with beam of 45 feet and 25 feet molded depth. Their lumber-carrying capacity is to be 2,100,000 feet and deadweight capacity 3,000 tons. Three will have twin semi-Diesel engines of 240 horsepower and three of 385 horsepower, all of the Skandia type.

Two-thirds, or about 10,000 tons, of the steel plates entering into the construction of five Norwegian steamers to be built by J. F. Duthie & Co., of Seattle, will be fabricated at the plant of the Northwest Steel Company, at Portland. With the seven steamers it had previously signed contracts to build at Portland, this will make practically twelve Norwegian steel

vessels for which the Northwest Steel Company will fabricate the material. The fleet will have an approximate value of $12,000,000.

Including those being turned out at St. Helens, which is in the Portland customs district, more than $16,000,000 worth of ships is being turned out at Portland.

Contracts for structural steel for the new hospital ship being built at the Philadelphia navy yard and the fuel ship at the Boston navy yard were awarded October 4 by the Navy Department at prices about 33 percent higher than were paid for similar material last December.

Shipyard News

Jose Marimon, president, Banco Espanol, Havana, Cuba, has acquired control of the Standard Shipbuilding Corporation, 44 Whitehall street, New York City. It is the intention of the new management to expend about $2,000,000 in developing the plant at Shooters Island, N. Y. New slips and power houses will be built to increase the capacity of the yard to sixteen ships. A considerable portion of this expenditure will be for equipment, including machines and pneumatic tools, cranes plate bending rolls, punching and shearing machines, hydraulic presses, etc. Orders for a portion of this equipment have already been placed. At the present time six steamers for foreign delivery are being built at the plant, each of which requires approximately 3,000 tons of steel. The first of these steamers is to be delivered about December. The officers of the company are Jose Marimon, president; Wallace Downey, first vice-president and general manager; W. R. Bush, second vice-president, and Henry W. Baird, secretary and treasurer.

The Pan-American Shipbuilding & Salvage Company has been organized in New Orleans, La., with offices suite 925, Whitney building. It is reported that the new company will have a capital stock of $1,000,000, that a site has been selected on the Mississippi River near New Orleans, and that keels of four four-masted schooners will be laid in a few weeks. The new concern is in the market for the usual ship supplies and wood-working machinery.

The Vancouver Shipbuilding Company has been organized in Vancouver, Wash., by James Feeney and G. B. Percival. The new company has secured a site for its plant and is reported to have already received a contract to build a wooden sailing vessel.

The Board of Trade, Orange, Tex., is promoting the organization of a company in Orange, Tex., to build a shipbuilding and repair plant to cost about $150,000.

The Columbia Engineering Works, Portland, Ore., plans to build another set of ways for ship construction.

The Dumphy Boat Works, Eau Claire, Wis., will build a new factory building.

Improvements planned by the Pusey & Jones Company, Wilmington, Del., include a 70 by 200-foot shop, equipped with traveling cranes, punches and shears. Another building 50 by 300 feet will also be constructed.

The Vancouver Shipyards, Ltd., Vancouver, B. C., are considering trebling the size of their yard.

The Seattle Construction & Dry Dock Company, Seattle, Wash., will soon begin work on the construction of a 12,000-ton floating dry dock.

The Sun Shipbuilding Company, Philadelphia, Pa., is expected to have its yard in Chester, Pa., ready to build ships before the end of this year.

It is reported that Pittsburg capitalists will build a $1,000,000 shipbuilding and dry dock plant at San Diego, Cal., and that the new concern has already received contracts to build six 2,000-ton steamships for George Culver, Los Angeles, Cal.

The Heath Shipbuilding Company, Portland, Ore., has secured a site in South Portland for its new plant. George E. Hardy and E. W. Heath, Portland, are among the incorporators. The company is incorporated at $100,000, and will have four building berths.

John Martinolich, Tacoma, Wash., has drawn plans for the shipyard of the new Northern Shipbuilding Company, Tacoma, of which he is president. The company is reported to have already received contracts to build several wooden vessels.

The plant of the F. C. Smith Shipbuilding & Dry Dock Company, Norfolk, Va., established nineteen years ago by F. O. Smith and George W. McCoy, has passed into the hands of five prominent men identified with the marine railway business in Norfolk. The name of the firm will not be changed. George W. Roper, president of the Norfolk Marine Railway Company, is president, and B. C. Colonna, of the Colonna Marine Railway Corporation, is secretary.

Control of the Delaware Shipbuilding Company, Seaford, Del., has been secured by Mr. V. Johnsen, president of the ship brokerage firm of Hennevig & Johnsen, Inc., New York. Under the new management the firm will make a specialty of building large wooden schooners.

The Fore River Shipbuilding Corporation, Quincy, Mass., is making preparations for constructing the largest vessels called for by the recent naval appropriations. Plans have been made for lengthening two slips to accommodate battle cruisers.

New ways are rapidly nearing completion at the yard of the Pusey & Jones Company, Wilmington, Del., to accommodate the building of steel vessels of much larger tonnage than was possible hitherto.

The Bay Point Marine Ways at Pensacola Bay has installed a complete plant, enabling the firm to haul out and repair much larger vessels than could be handled formerly.

The William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., has let contracts for the construction of four large shops, including pipe and ship shops and a power plant.

The Mare Island navy yard, San Francisco, Cal., is now employing 2,940 men, the weekly payroll amounting to $59,000. The first actual work on the building of the battleship *California* at this yard was begun on September 13.

At the Portsmouth navy yard, Portsmouth, N. H., the unusual amount of work on hand is delayed on account of lack of skilled and unskilled labor. Two hundred additional skilled mechanics could be employed at once.

The new 1,000-foot dry dock at Balboa on the Panama Canal is virtually completed. The dock is 110 feet wide and has a depth of water over the blocks of 35 feet at mean tide and 45 feet at high tide. With the terminal shops and foundries this plant is equipped for doing practically any sort of ship repair work.

Recent Launchings

The Maryland Steel Company, Sparrows Point, Md., launched on September 28 for the Bull Insular Steamship Company, New York, the steamship *Helen,* 338 feet long by 46.6 feet beam by 26.3 feet depth of 3,800 gross tons and 12 knots speed.

The Tampa Foundry & Machine Company, Tampa, Fla., launched on September 23 the steamer *Poughkeepsie,* designed by J. W. Millard & Bro., naval architects, New York, for the Central Hudson Steamboat Company. The vessel is 216 feet long by 36 feet 6 inches beam by 15 feet depth, and is designed to operate between New York and Kingston.

The Chicago Shipbuilding Company, South Chicago, Ill., launched on October 14 the steamship *Mantua,* 261 feet long by 43 feet beam, which is being built for the Gulf & West Indies Steamship Company to ply between Atlantic ports and the West Indies.

The Harlan & Hollingsworth Corporation, Wilmington, Del., launched on October 13 the steamship *Georgeanna Weems,* 225 feet long by 39 feet beam by 26 feet deep, with a cargo-carrying capacity of 1,700 tons, which is being built for the Baltimore & Carolina Steamship Company.

The William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., launched early in October the new car ferry *Joseph R. Parrott,* a duplicate of the *Henry M. Flager,* for the Florida East Coast Railway Company to operate between Key West and Havana.

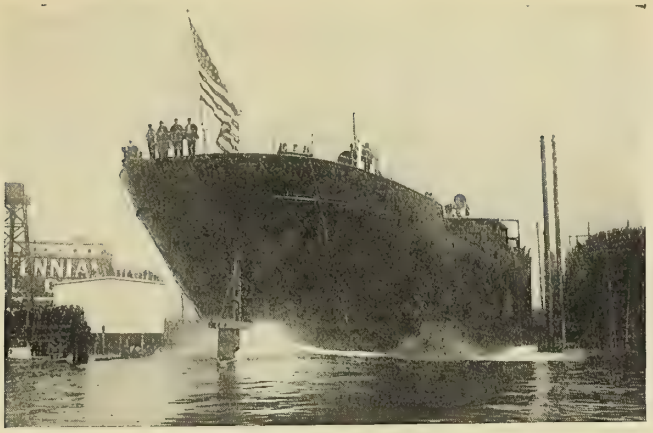
The Moore & Scott Iron Works, Oakland, Cal., launched on October 14 the 7,100-ton turbine steamship *Capto,* under construction for Hon. James Rolph, Jr., Mayor of San Francisco.

The California Shipbuilding Company, Long Beach, Cal., launched on September 28 the United States submarine *L-7.*

The Seattle Construction & Dry Dock Company, Seattle, Wash., launched on September 23 the 6,000-ton freighter *Cauto,* 368 feet long by 47.9 feet beam by 27.3 feet depth, for the New York & Cuba Mail Steamship Company (Ward Line).

The Kruse & Banks Shipyard launched on September 26 the steam schooner *Port Angeles,* 235 feet long by 42 feet beam of 15 feet 6 inches depth, for the Charles Nelson Company, San Francisco, Cal.

The schooner *Columbia River,* which has a capacity of 1,500,000 feet of lumber, was launched at Aberdeen, Wash., on September 30.



Views of the Launching of the S. S. *Niels Nielsen* at the yard of the Skinner & Eddy Shipbuilding Corporation, Seattle, Wash.

Forty-Four Merchant Ships to be Equipped with Westinghouse Geared Turbine Propelling Machinery

Orders totaling more than $2,700,000 have recently been received by the Westinghouse Machine Company, of East Pittsburg, Pa., for equipping with propelling machinery 44 merchant ships now under construction or contracted for at the yards of shipbuilding companies on both the Atlantic and Pacific coasts. The company also has in immediate prospect the equipping of 16 merchant ships in addition to the 44 above mentioned, bringing the total number of ships up to 60, and the total value of the orders for machinery to be supplied by the Westinghouse Machine Company to approximately three and three-quarter million dollars.

The ships are to be equipped with the latest refinements in the line of propelling machinery, consisting of Westinghouse turbines with double reduction gears, and with few exceptions condensing equipment. The first ship which has been so equipped is the *Malmanger,* launched at the Chester Shipbuilding Company, Chester, Pa., on August 26, 1916.

The business above described covers strictly merchant ships, and does not include orders received for propelling machinery for the United States Navy or for foreign governments.

First Launching at Skinner & Eddy Shipyard

On September 21 the first ship built at the newly organized shipyard of the Skinner & Eddy Corporation, Seattle, Wash., was launched, with due pomp and ceremony, for Mr. B. Stolt-Nielson. She is the *Niels Nielsen,* and will fly the Norwegian flag, her port of registry being Haugesund, Norway. She is the first of a number of her type being built. Her sister ship, the *Hanna Nielsen,* will be launched about a month later.

The general dimensions of the ship are: Overall length, 423 feet 9 inches; beam, 54 feet; depth, 29 feet 9 inches; load draft, 24 feet 2 inches; speed, 11½ knots; deadweight, 8,800 tons. She is a single-screw ship of the poop, bridge and forecastle type, with two decks and machinery amidships; being built under the survey of Lloyd's to Class 100-A-1, and is the largest cargo ship so far built in the Northwest.

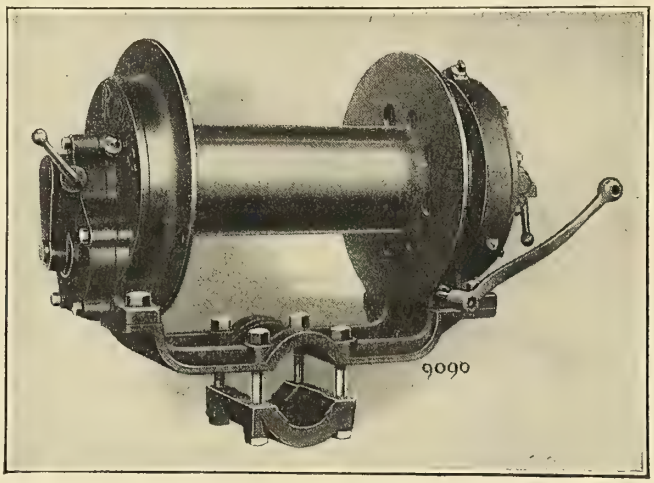
She will be equipped with three Scotch marine boilers, 14 feet 9 inches in diameter and 11 feet long, having 2,680 square feet of heating surface and a working pressure of 210 pounds per square inch, burning oil or coal. They are being built by the Commercial Boiler Works. These will furnish steam to Curtis turbines of the General Electric Company's manufacture, developing 2,500 shaft horsepower at 100 revolutions per minute, geared to the shaft driving a four-blade propeller of 16 feet 5 inches diameter. There will be five stages in the ahead and two stages in the reverse turbine.

For the handling of cargo this ship is equipped with two masts, having four 5-ton booms and one 30-ton boom and two derrick posts, each fitted with one 3-ton boom. There are five main cargo hatches.

The keel of this vessel was laid on May 2, but actual construction work was not started until June 6. From this date on the work progressed rapidly and smoothly under the direction of Mr. David Rodgers, the works manager, formerly of the Seattle Construction & Dry Dock Company; and due to his efforts and able management this early launching date became a possibility. Immediately upon launching the keel blocks were prepared and the keel of contract number seven was laid.

New Model Little Tugger Hoist

For the use of those who prefer manila rope to wire rope for light hoisting and hauling, the Ingersoll-Rand Company, New York, has brought out a new model "little tugger" hoist which is designated No. 11. The square piston, reversible driving engine, automatic lubrication, enclosed gearing, drum release clutch and worm-operated band brake, are essentially the same as in the No. 1 model manufactured by this company. The main differences are in the diameter and length of the drum, the width of the flanges, and, necessarily, the main frame and overall dimensions.



Little Tugger Hoist

The new No. 11 "little tugger" has a hoisting drum 7 inches in diameter by 17 inches long with 5-inch flanges. This accommodates 300 feet of ⅞-inch manila rope. The maximum capacity of this hoist is conservatively rated at 600 pounds. The weight of the hoist itself is 358 pounds. It is 21½ inches long, 31¼ inches wide and 23 inches high.

Like the No. 1, the No. 11 "little tugger" is built for operation both by compressed air and steam. The standard clamp fits a 4½-inch diameter column or pipe, but by removing the clamp the hoist can be readily bolted directly to any convenient support, timber, flooring, etc. The device is recommended by the manufacturers for all around hoisting, hauling and handling in industrial plants.

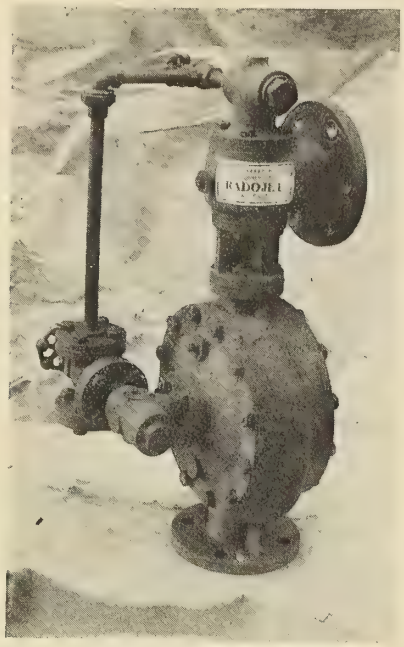


Fig. 1.—"Radojet" Air Pump

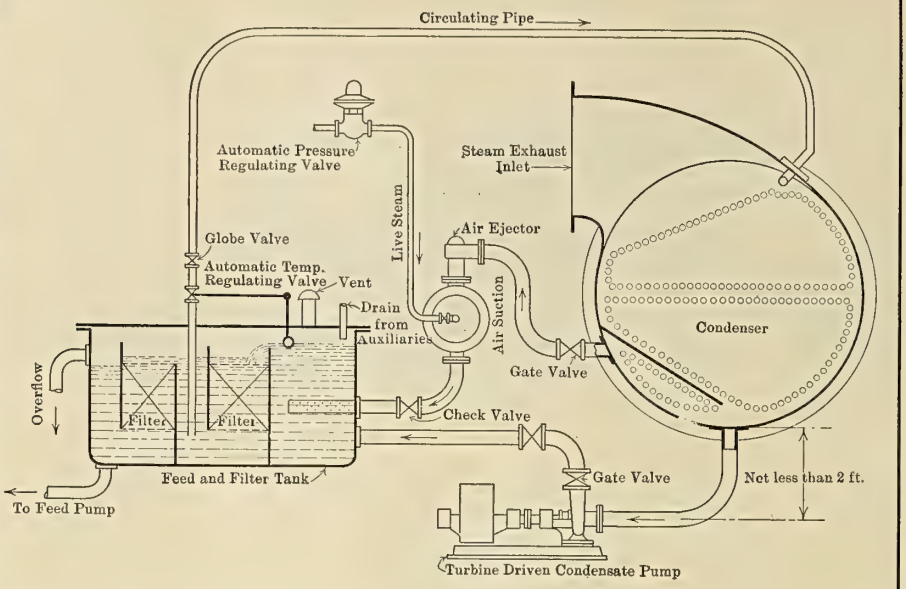


Fig. 2.—Diagrammatic Arrangement of "Radojet" Air Pump in Marine Condensing Plant

The "Radojet" Air Pump

A new type of air pump, called the "Radojet" Air Pump (Patented) for producing highest possible vacuum economically, was recently introduced by the C. H. Wheeler Manufacturing Company of Philadelphia. Usually a radical improvement in economy or efficiency is attained by increased complications. In this air pump, however, the improvements were attained by simplification.

The new device is a substitute for any air pump working on the dry air principle, of either the reciprocating, rotative, rotary or hydraulic entrainment type. It has no piston or valves, and is operated by live steam jets which by passing through nozzles of patented design obtain a high velocity that entrain the air and non-condensable gases from the condenser and compress same to atmospheric pressure.

Fig. 1 shows a Radojet air pump for a surface condenser condensing about 20,000 pounds of steam per hour. The size of this pump is extremely small, requiring very little space.

A diagrammatic arrangement of the Radojet air pump as used on marine surface condensers for turbines is shown in Fig. 2. The exhaust steam from the pump is discharged into the feed tank in a condensed form, and serves to raise the temperature of the feed water. In other words, all the heat contained in the live steam used for the operation of the pump is utilized, thus giving, it is claimed, a thermal efficiency of practically 95 percent. The condensed steam is taken from the hotwell of the condenser by a turbine or electric driven condensate pump and discharged into the feed water tank, where it mixes with drains from other auxiliaries and the exhaust steam coming from the Radojet air pump. A separating wall with an overflow is provided to force the water to rise, thereby freeing the air which escapes through a vent arranged on the top cover of the feed tank.

The Radojet air pump may be located at any convenient place close to the condenser. The air suction should be arranged a little higher than the air suction of the condenser, so as to form a drain towards the condenser.

An automatic steam pressure regulating valve is supplied with the Radojet air pump, which should be arranged somewhere in the highest point of the live steam line. Its purpose is to maintain a constant steam pressure at the inlet of the air pump, thereby insuring a uniform steam consumption with varying boiler pressure.

The back pressure on the exhaust of the Radojet air pump should not exceed one-half pound gage. A circulating pipe with a float-operated valve is also seen in Fig. 2. The object of this circulating pipe is the following: If the main engines of a marine installation come to a sudden stop, as is frequently the case when maneuvering, very little water will be discharged by the condensate pump to the feed tank. The Radojet pump being in operation, steam will continuously enter the feed tank, and the heat contained in the steam will cause an increase of temperature of the water in the feed tank, which may soon reach the boiling point unless some additional water supply is provided for; the float-operated regulating valve and the circulating pipe serve this purpose. As soon as the quantity of water supplied to the feed tank becomes smaller, the water level in the first compartment of the tank will fall, thereby opening the automatic regulating valve and allowing some water to be sucked into the condenser through the circulating pipe. This water by falling down over the cooled tubes will be reduced in temperature and will be returned by the condensate pump to the feed tank, thus preventing boiling.

The Radojet air pump may also be used with advantage with reciprocating engines where lower vacua than those provided for on turbine installations are required. The reciprocating air pump, which is generally operated directly by a lever connected with links to the crosshead of the main engine, will be replaced by the Radojet air pump removing the air, with a small direct-acting hot well pump for removing the condensed steam from the condenser.

The advantages of this new device may be summarized as follows:

1. Extreme simplicity and consequent ease of manipulation and operation. The apparatus is static. All that is required to start it is to open the steam valve; and to stop it, to close the same. No attention is required during its running.
2. Minimum space requirements as compared with other types of vacuum producing apparatus, the space occupied being about one-tenth of that of an ordinary reciprocating pump.
3. Minimum weight, the weight being about one-sixth that of a reciprocating air pump.
4. Complete absence of internal moving parts, so that wear is eliminated and the efficiency does not drop off after long periods of operation.
5. Great flexibility in locating the apparatus, which is of importance for marine installations.
6. Highest efficiency, the steam consumption of the apparatus being less than that of the reciprocating air pump.

Wooden Shipbuilding Offers Employment for Skilled Labor in Portland, Ore.

With twenty-seven ships either under construction or contracted for at Portland, Ore., the city expects that the industry will become an important and permanent employer of skilled labor.

Shipbuilding on the Columbia and Willamette rivers of

Banquet to Shipbuilders of the Northwest Given by the Manufacturers' Association of Seattle at the New Washington Hotel, Seattle, Wash., on September 21

Oregon begins in the yards at Astoria, at the mouth of the Columbia, is in progress at St. Helens and at half a dozen yards in close proximity to the big sawmills along the waterfront at Portland. Auxiliary power ships comprise the majority of the construction.

Oregon has one-fifth of the standing timber of the United States, a fact which should give shipbuilders an advantage that will insure employment to large numbers of carpenters for many years.

It is thought that it will require a period of years to restore anywhere near the amount of tonnage that has been taken from the seas as a result of the European war, and that the development of the auxiliary power craft will always make the wooden ship a competitor for certain lines of business.

Banquet of Northwestern Shipbuilders

Commemorating the event of the Northwest's début as a great shipbuilding center, ushered in by the launching of the 8,800-ton steel cargo steamer *Niels Nielson* at the plant of the Skinner & Eddy Corporation on September 21, and followed immediately by the launching of the 5,250-ton steel steamship *Cauto* at the plant of the Seattle Construction & Dry Dock Company on September 23, a banquet given under the auspices of the Manufacturers' Association of Seattle to the shipbuilders of the Northwest was held at the New Washington Hotel, Seattle, Wash., on the evening of September 21.

About 275 men, representing practically all the industrial developments of the Northwest, attended. Among this number were representatives of thirty-five shipbuilding companies in the states of Washington and Oregon, and a portion of British Columbia, which companies had on hand at the time contracts aggregating about $30,000,000.

The setting of the spacious dining-room was extremely unique, the entire decorating scheme being in harmony with the event. On each table was a miniature sailing vessel, while on the speakers' table rested a large model of a cargo steamer surrounded by navigating instruments. A large ship's lantern was hung from every chandelier, and at the far end of the room a lighthouse flashed alternately its red and white signals. The remainder of the room was decorated with buoys, oars, fish nets, etc., while the waiters in attendance were garbed in the attire of seamen.

Mr. William Pigott, president of the Manufacturers' Association, was toastmaster of the evening. His introductory remarks showed how the latent spirit of the Northwest had suddenly awakened and grasped the opportunity of industrial development and was now striving to make use of all the possibilities available. Mr. Kenneth C. Kerr, editor of the *Railway and Marine News*, outlined in part the status of shipbuilding in the Northwest and the representative valuation incurred thereby. President Henry Suzzallo, of the University of Washington, pointed to the fact that if this new industrial development was to be successfully carried through, it was imperative that the Federal Government must first aid and not restrain the initiative of the men who are eagerly working for the betterment of our merchant marine. This point was also emphasized by Mr. D. E. Skinner, president of the Skinner & Eddy Corporation, who also made mention of the fact that there is no future for the American merchant marine with the laws we now have, and that therefore people should not be too sanguine as to the future of shipbuilding in this country after the war. Mr. Will H. Parry, member of the Federal Trade Commission, gave a short but interesting historical synopsis of shipbuilding in the Northwest, which was pictured by lantern slides. Moving pictures of the launching of the *Niels Nielson* that afternoon concluded the event.

PERSONAL

Samuel P. Goman, formerly superintendent of the Harlan & Hollingsworth Corporation, Wilmington, Del., is now a superintendent of the Sun Shipbuilding Company, Chester, Pa.

W. M. Hanna, formerly trial engineer at the Union Iron Works, San Francisco, Cal., has been appointed port engineer of the Admiral Line, with headquarters in San Francisco. Mr. Hanna has served as chief engineer of the fast turbine steamers *Yale* and *Harvard*.

W. Freeland Dalzell, president of the Dalzell Towing & Transport Line, New York, has been appointed a member of the executive committee of the National Board of Steam Navigation.

J. W. Isherwood, of London, inventor of the Lidgerwood system of longitudinal framing for ships, has offered, through an English marine publication, a prize of $2,500 for the next airman who brings down a Zeppelin on British soil.

Charles I. Gibbs, general superintendent of the Ward Steamship Line, died recently at his home in Brooklyn, aged 53. Mr. Gibbs was in the employ of the Ward Steamship Company for thirty years.

Col. Robert C. McKinney, chairman of the board of directors of the Niles-Bement-Pond Company, New York, died at his home at Belle Haven, Conn., on October 3, aged 65 years.

Capt. Thomas S. Marvel, founder of the former Marvel Shipyard, Newburgh, N. Y., where the Morgan yacht *Corsair* and the Hudson River steamers *Hendrik Hudson, Trojan* and *Rensselaer* were built, died in Newburgh on October 25, aged 82.

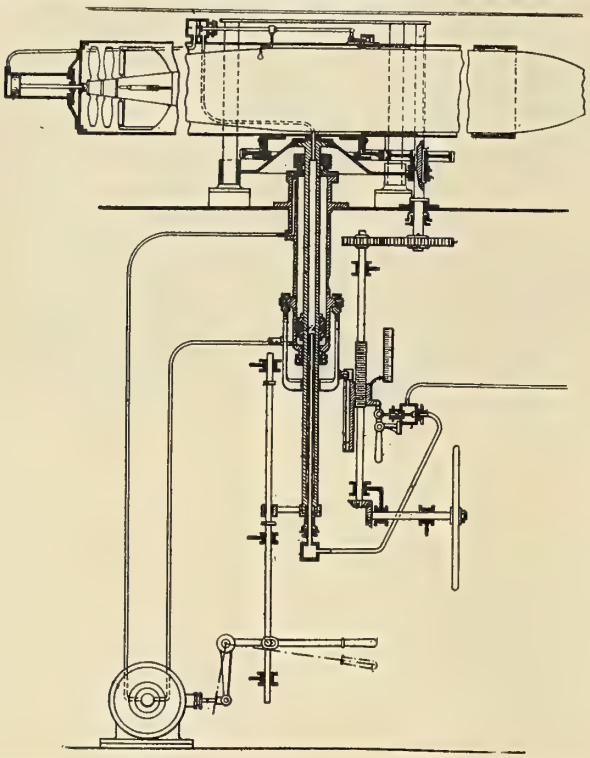
SELECTED MARINE PATENTS

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents, compiled by Delbert H. Decker, Esq., registered patent attorney, Millerton, N. Y.

1,166,940. TORPEDO LAUNCHING APPARATUS FOR SUBMARINE VESSELS. EUGENE SCHNEIDER, OF LE CREUZOT, FRANCE.

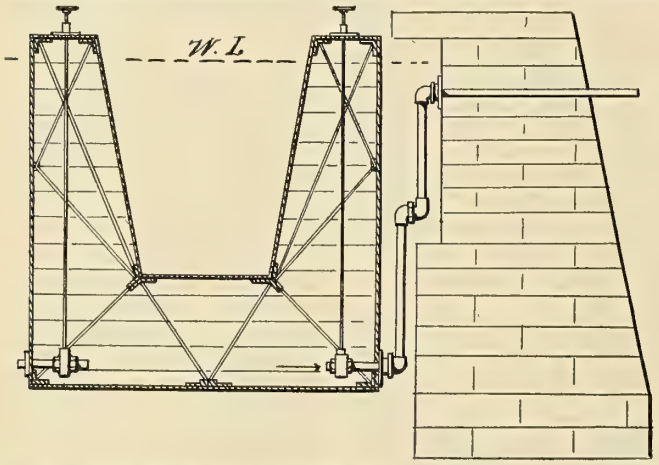
Claim 7.—In a submarine vessel, a torpedo compartment having therein a movable torpedo support, guiding members for said support, a torpedo carrying frame pivoted on said support, a motor outside said



compartment for moving said support clear of the vessel superstructure or deck, training mechanism released by a predetermined movement of said frame for rotating the latter into launching position, and means released by the operation of said training mechanism for launching a torpedo from said carrying frame. Twelve claims.

1,181,030. FLOATING DRY-DOCK. ROBERT O'NEILL, OF BUFFALO, N. Y.

Claim 1.—The combination with a hollow, floating dry dock having an intake pipe and a controlling valve therefor, of a discharge pipe, an outlet



pipe from the dry dock and swiveled pipe sections between said outlet pipe and the discharge pipe adapted to form a siphon. Two claims.

1,182,208. SUBMARINE-BOAT ATTACHMENT. WILLIAM H. RAMM, OF SEATTLE, WASH.

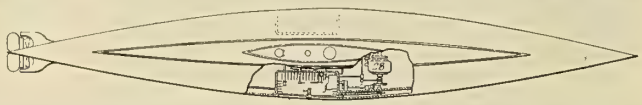
Claim 11.—A boat indicator comprising a float, a casting secured to the boat, tubes connected to the casting, a cable secured to the float and passing through the tubes and casting, a cylinder secured to the casting, a piston operating in the cylinder, and means carried by the piston and operating in the casting for severing the cable. Twenty-nine claims.
blades. Eight claims.

1,181,339. MINE AND SUBMARINE DESTROYER. WILLIAM H. NORFOLK, OF SAN PEDRO, CAL.

Claim 1.—A dirigible net comprising a submarine float structure, a series of supplemental float members, flexible means for connecting said float members and a submarine structure, means for propelling the submarine structure controllable from a remote point, and means for directing the movement of the submarine structure. Four claims.

1,183,163. ESCAPE APPARATUS FOR SUBMARINES. RENE BRUNET, OF NEW YORK, N. Y.

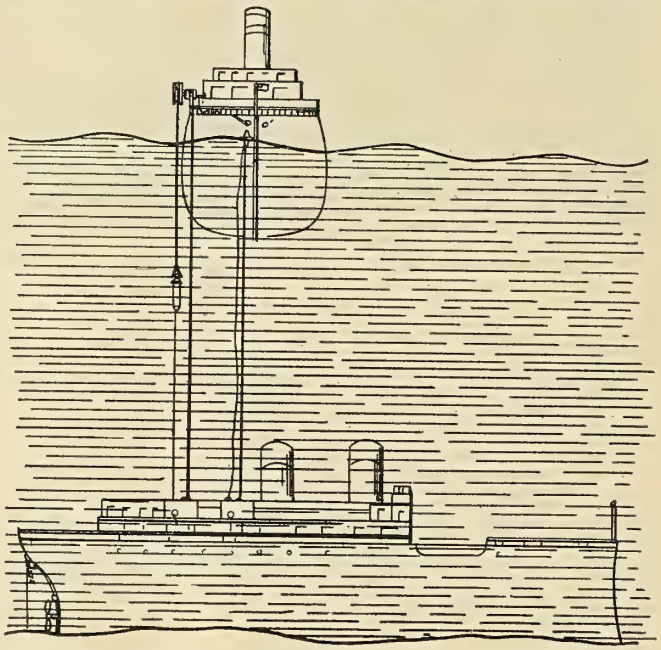
Claim 2.—In connection with the safety compartment of a submarine sea doors a plurality of power units for operating and closing said doors,



means for operatively connecting any one of said power units to said doors, and means for controlling said connecting means. Three claims.

1,183,078. MARINE LIFE-SAVING APPARATUS. JOSEF KONRAD, OF SPOKANE, WASH.

Claim 3.—In a marine life-saving apparatus, a ship, an air-tight habitable housing mounted on said ship, a human rescue container projected into and having an air-tight fit in said housing and provided with a grapple head projecting from said housing, a captive line connected with said container, means connected with said captive line and operable in



said housing for lowering said container into said housing, a buoy, a guiding line detachably connected with said buoy and connected with the grapple head of said container, and a hoisting cable having a grapple provided with means for guiding connection with said guiding line to guide said grapple into hoisting connection with said grapple head of said container. Eight claims.

British patents compiled by G. F. Redfern & Co., chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 10 Gray's Inn place, W. C., London.

4,704/15. HOLLOW HASTS, SPARS, STRUTS AND OAR-SHANKS OR THE LIKE. E. McGRUER, JR., OF BRAESIDE, CLYNDER, DUMBARTONSHIRE.

The invention relates to a method of bending wood from the flat board into tubes of circular, oval, or streamline-form transverse section. Where the edges meet end enclose the required section, a scarf-joint is worked and glued. In members made up with superposed laminar, glue is used all over the paying surfaces. The invention allows of masts, spars, struts, oar-shanks and the like being made tubular, in one, two, or more laminæ.

15,473/15. COLLAPSIBLE BOATS. A. A. THORNTON, OF QUALITY COURT, CHANCERY LANE, LONDON, W. C. (COMM. FROM F. HERZIK, OF 2002 PIERCE AVENUE, LOUIS MARTIN HERZIK, OF 502 MAIN STREET, AND A. J. VASICEK, OF 1008 TRAVIS STREET, ALL OF HOUSTON, COUNTY OF HARRIS, STATE OF TEXAS, U. S. A.)

This invention relates to boats which are adapted to be rolled up for storage or other purposes when collapsed, and to that end are formed of strips hinged together by being secured to a flexible covering, and arranged to lie parallel with each other when in collapsed position in order to permit of the rolling-up operation. The invention consists in the provision of an improved boat of the above-mentioned general character, having its sides and bottoms formed of strips hinged together and its ends formed of flexible material, whereby the boat is adapted to be rolled up, in combination with means for tending to hold the boat normally in open or operative position. The means preferably employed for accomplishing this consists in general of a spring or springs held in tension around the outer periphery of the boat, and in order to provide for the rolling up of the boat into its collapsed form to be easily accomplished means are provided for controlling the tension of these springs. Thus the tension can be relieved during the rolling-up operation and then so increased that immediately the boat is released it will at once adopt its open form. A further feature of the invention resides in the provision of means for securing the boat in collapsed position and means for releasing said securing means.